THE JOURNAL OF GAS LIGHTING
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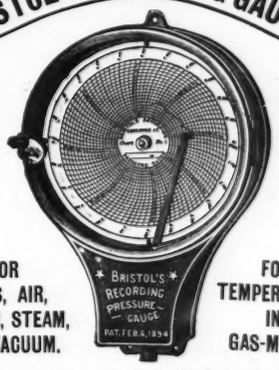

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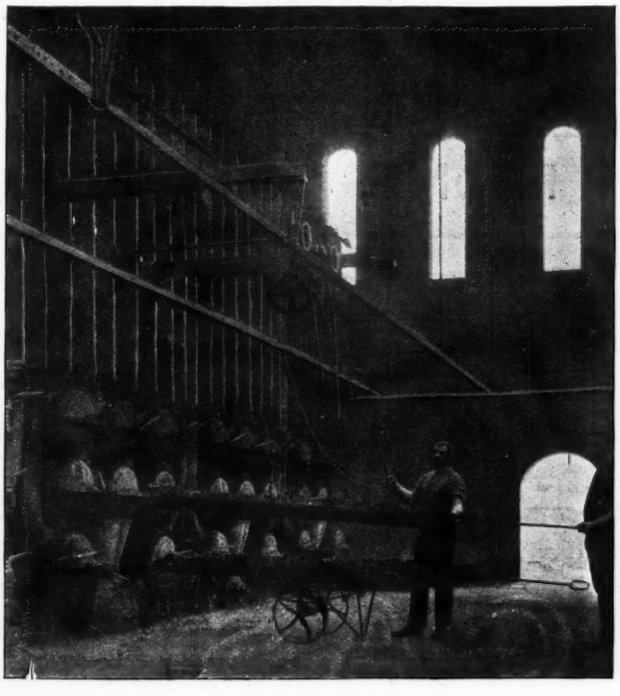

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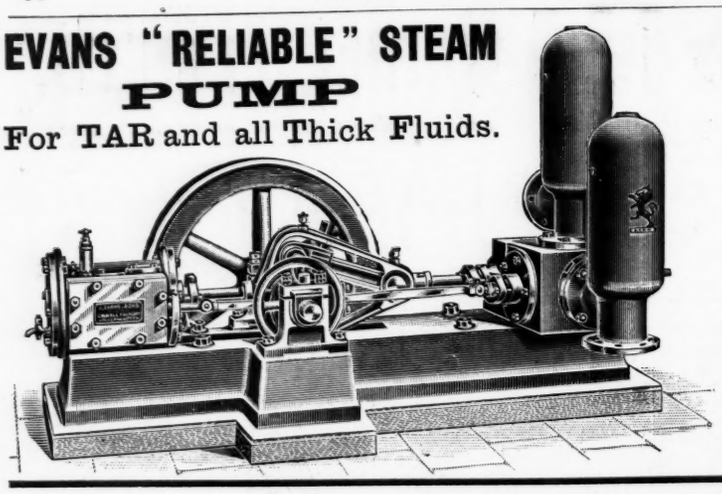

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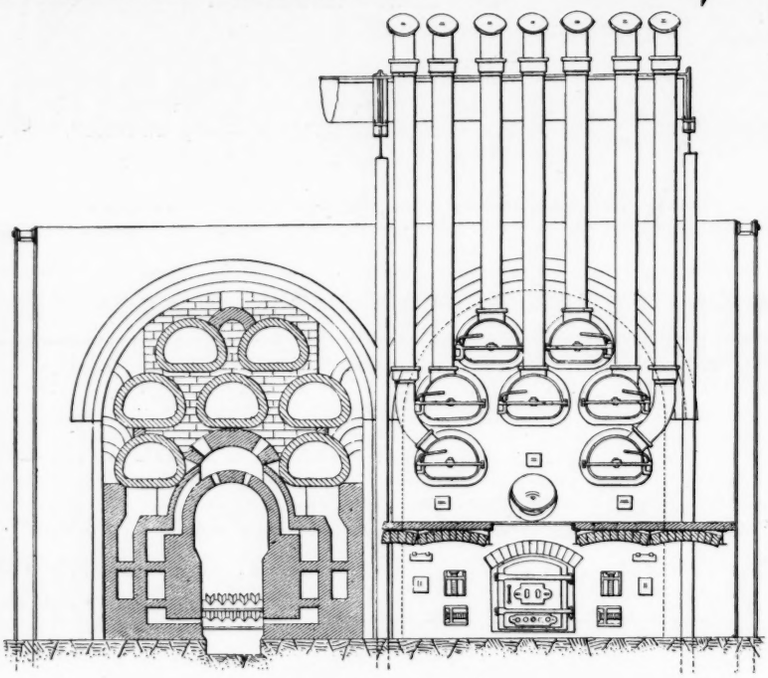

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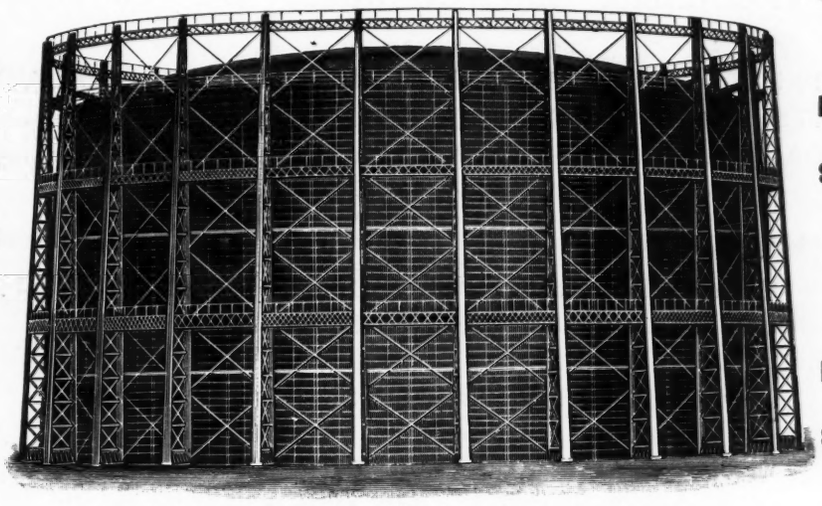

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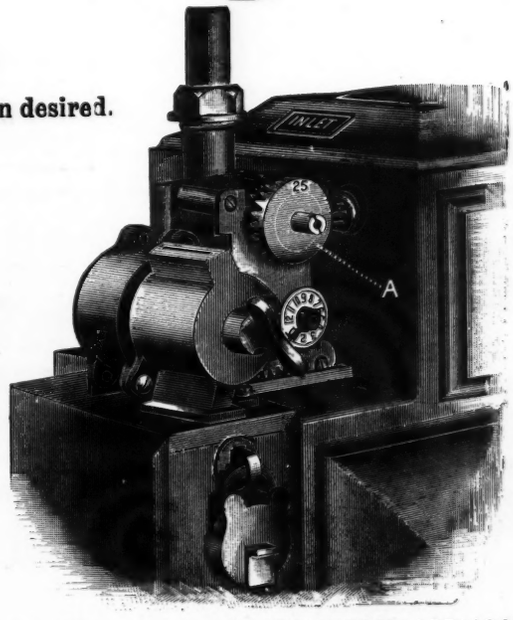

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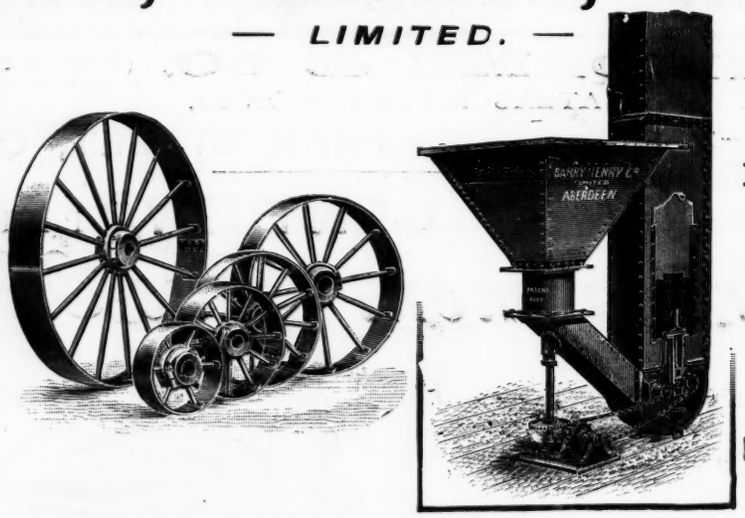

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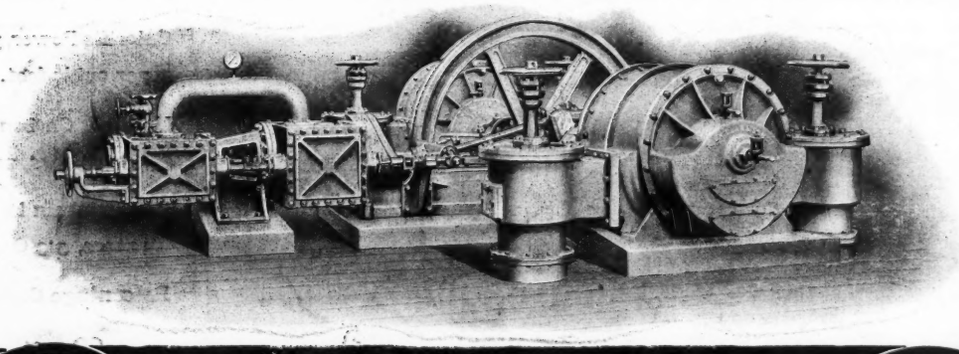

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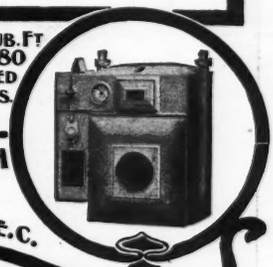

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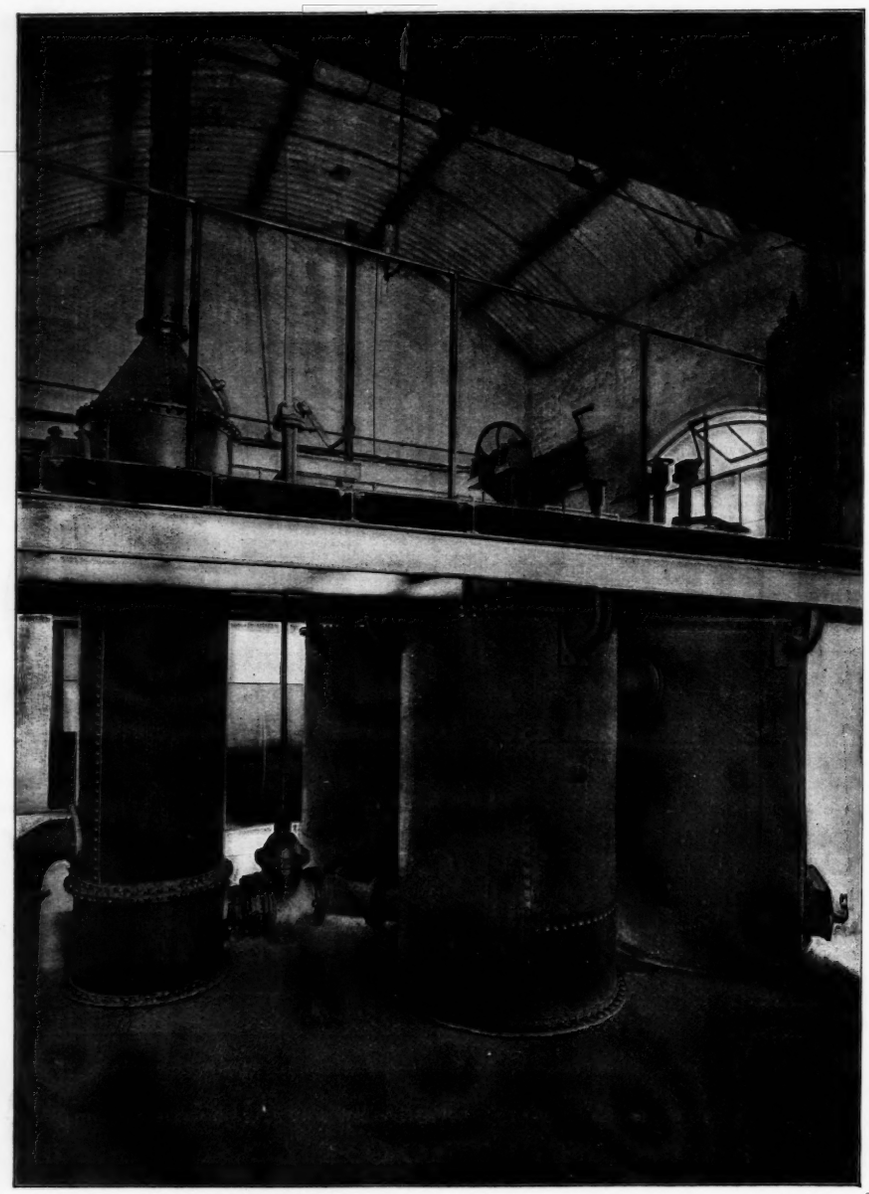

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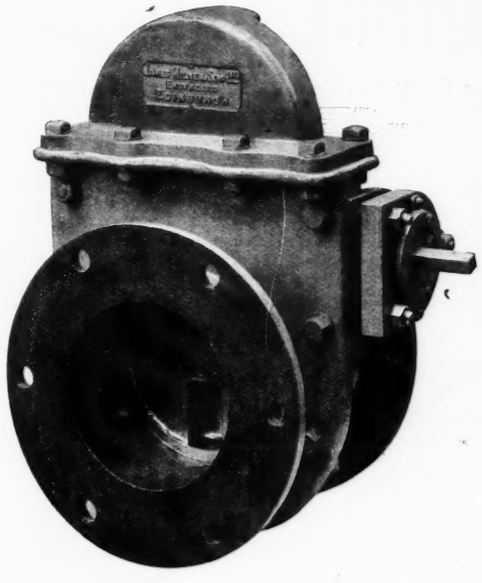

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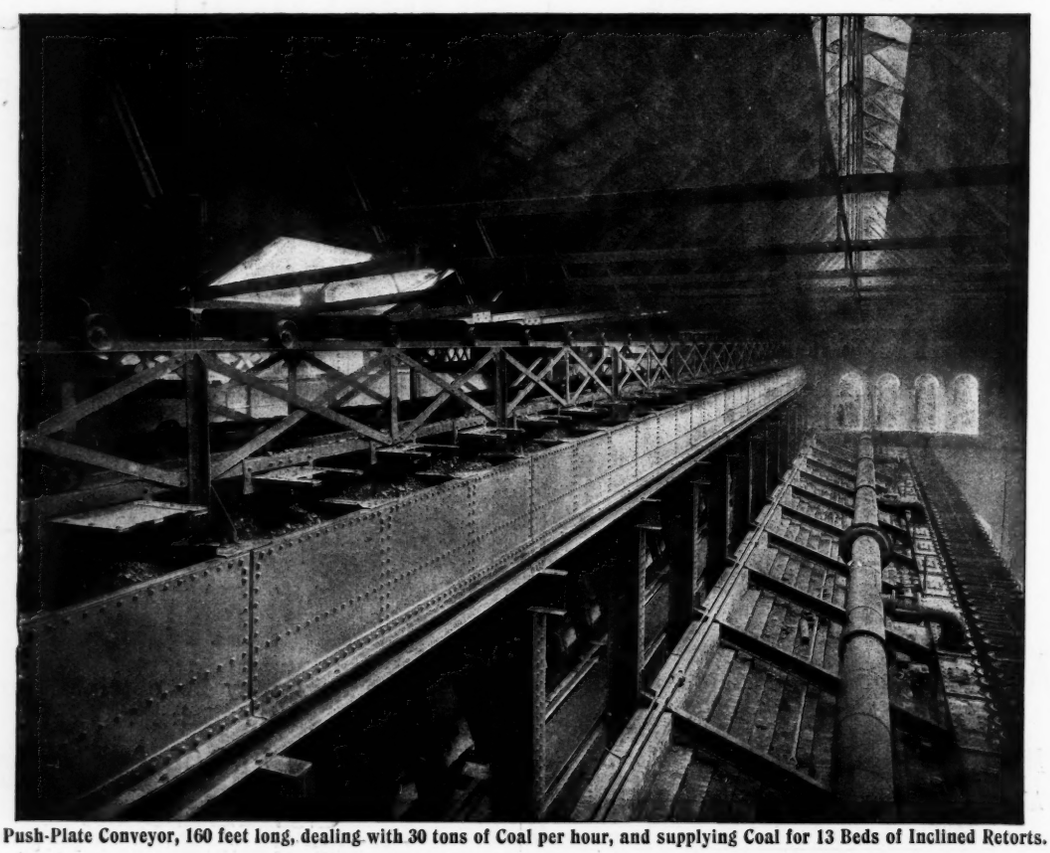

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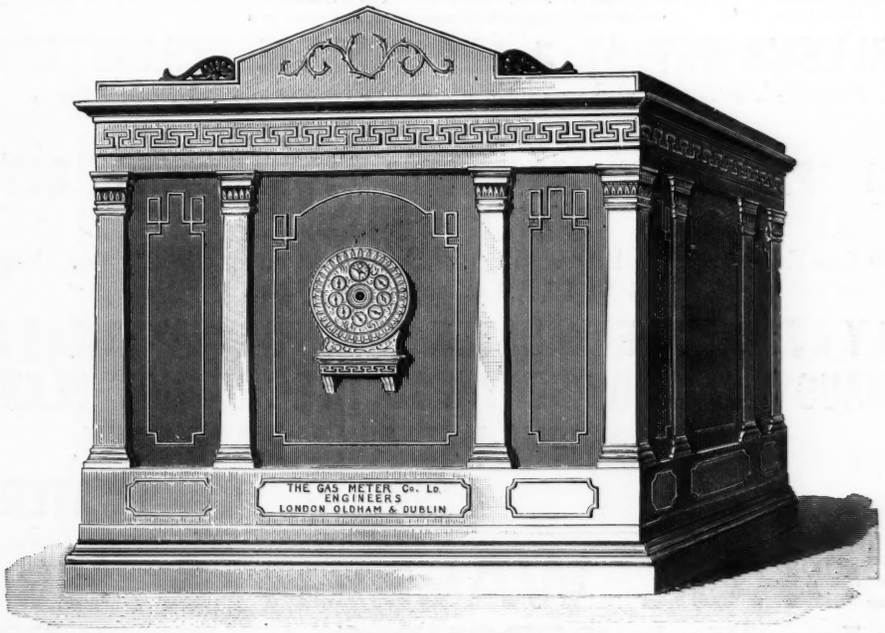

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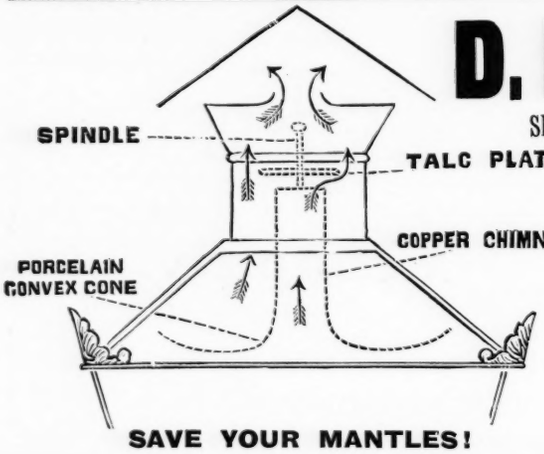

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EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. XCI., No. 2200.—TUESDAY, JULY 11, 1905.

EDITORIAL NOTES—GAS, &c.

The London Gas Bill—The Last Phase.

THIS Bill came before Lord Rosse's Committee for final settlement last Tuesday; and, as the result, it was ordered, as amended, to be reported to the House of Lords. The terms of compromise as to the method of testing for illuminating power which had been previously arranged between the London County Council and the Metropolitan Gas Companies proved to be such as were foreshadowed in our "Editorial Notes" last week. The Council are to retain—in order to save appearances, and for what it may be worth—the 5 cubic feet rate of consumption. That it can be worth nothing to them, except as a concession to sentiment, is apparent from the fact that the Companies are to have the most suitable burner for the quality of gas which they respectively supply, which may involve the use of a separate burner in each case, having regard to the mixture of coal gas and carburetted water gas supplied by two of them.

The new clause in the Bill by which this is prescribed is, in effect, a re-enactment of the provision of 1868. It reads as follows:—

> The Gas Referees shall from time to time prescribe the burner for testing the illuminating power of the gas supplied by the company, and the chimney (if any) to be used with such burner. The burner so prescribed shall be of such a pattern (not being an incandescent or similar burner) as shall be practicable for use by the consumer; and the burner and the chimney (if any) shall be the most suitable for obtaining, and in making the test shall be so used as to obtain, from the gas when consumed at the rate of 5 cubic feet an hour the greatest amount of light.

This amply secures the Companies from the injustice which was sought to be perpetrated by the proposal to test the 14-candle gas by the 5 cubic feet rate of consumption method applied to the No. 1 "London" argand burner. It does much more than this; it entitles the Companies to all the advantage that may be secured by an improved burner "practicable for use by the consumer." There has not been for many years any incentive to the improvement of the argand burner, although it has long been known that such improvement is practicable. Now that the incentive has been supplied, the result may be anticipated with confidence. At the same time, it is much to be regretted that the prospect of the establishment of a uniform system of testing has receded almost in proportion to the greatness of the victory which has been won by the Companies. For it is but natural, notwithstanding the great desire for uniformity of method to which expression was given in the memorial of the Institution of Gas Engineers to the Board of Trade, that those Companies who may in the near future find themselves under the necessity of applying for additional parliamentary powers, should desire to obtain similar terms to those which have been secured by the Metropolitan Companies. There would be no great objection to this if the standard of illuminating power throughout the country were likely to be fixed and to remain at 14 candles. But there can be no such thing as finality in this respect; and a reduction to (say) 12 candles may soon become an accomplished fact. A separate burner for each quality of gas can only lead to confusion, besides being wholly unnecessary.

It is much to be hoped, therefore, that the Institution of Gas Engineers will not relax their efforts to secure uniformity of testing, either by the enactment of a fixed height of flame or a fixed illumination coupled with the use of the "London" argand burner for all qualities of common gas. It may be true enough that the opinion and aspirations of the gas industry are no concern of the London County Council. But it so happens that, in this particular question, these coincide with the only safe course which it was open to them to take, and that in doing violence to them they have deliberately betrayed the interests of the consumers. To what extent they have done so will be apparent hereafter. It is sufficient for the present to emphasize the fact that with a frank acceptance of the decision of Lord Rosse's Committee there could have been no such betrayal. Already, however, the London County Council officials must be chewing the cud of bitter reflections, for have they not been beaten all along the line? They experienced dire defeat down to the very last. They sought to exclude from the Bill the very reasonable provision added by the Commons' Committee for an average of three days to be taken for the purpose of determining any default in illuminating power, pleading as a reason the alteration made in the clause relating to testing. The Lords' Committee, however, decided to retain this provision, subject only to the illuminating power not being deficient in any one day more than one candle. Thus in every respect the Bill has been transformed into one for the advantage and the greater freedom of the Companies, who are to be heartily congratulated upon their success, and more particularly on the relief from the vexatious sulphur restrictions, which is now well within measurable distance. As for the London County Council, they will have plenty of time in which to repent of the false step which, guided by their evil genius, they took in seeking to upset the testing provisions of the South Metropolitan Gas Company's Act of 1900. It is their over-reaching in this respect which has been their undoing. They will in all probability think not twice but thrice before they again try their hand at gas legislation.

The German Association Meeting.

A WEEK ago last Sunday, the forty-fifth annual meeting of the German Association of Gas and Water Engineers came to a close, after a five days' round of festivities, interspersed with a modicum of technical proceedings. The members of the Committee, Professor H. Bunte, the General Secretary, and the other permanent officials of the Association, have become so skilled by practice in the organizing and conduct of these annual gatherings, that it is almost superfluous to remark that all the arrangements were as nearly perfect as possible, and all passed off with great success. The magnitude and the cosmopolitan character of these annual meetings take the casual English visitor somewhat aback; and he is led to wonder whether, with all respect for our own exemplary but rather arid methods of conducting our conclaves of gas engineers, they do not do these things better in Germany. Admittedly, the conditions are different. In the latter country, attendance at the meeting often constitutes the annual holiday of the smaller gas managers and their wives, who know from experience that so good a programme of amusements and excursions cannot be obtained elsewhere at the price. Notwithstanding the atmosphere of relaxation which thus prevails at the German meetings, the technical *pabulum* provided for the enlightenment of members is not despised, as will appear from our report last week of the number present at Coblenz when the more important papers were read. The President of the Association, Herr L. Körting, of Hanover, was loyally supported in his second consecutive year of office, by nearly all his engineering colleagues in the service of the Imperial Continental Gas Association; and those who witnessed the vigour and ability which he displayed in the chair will testify that he belied the Psalmist's view that after threescore years and ten a man's strength is but "labour and sorrow." May his present vigour and energy long remain to him!

The technical communications this year were of a somewhat less attractive order than usual. There was, of course, a description of the local gas and water works; but Coblenz cannot pretend to enlighten the world in such matters. Interest, in fact, centred round the scheme for the experimental gas-works which the Association are now erecting at Carlsruhe. A full account of these works was given in the "JOURNAL" last week; and we commend it to the careful attention of gas men. Suffice to say here that the works are to be fitted with a setting of two full-sized retorts, a water-gas generator, and all the customary gas-works' equipment of corresponding capacity. In addition, there are to be physical and chemical laboratories, and a photometer-room for the exhaustive examination of the materials used and

the products obtained in the works. The building and its fitting up are to be provided for the very moderate sum of about £3500; and it is reckoned that a fund yielding £500 per annum will suffice to meet the working expenses. The works are intended for instructional as well as experimental purposes; and if they are not allowed to deteriorate into a mere coal-testing institution, much good should accrue to the gas industry at large from their establishment. So long as Dr. Bunte and his present colleagues are responsible for the character of the research work carried out, we entertain no fear of any such deterioration of its purpose.

Communications on various gas topics were presented by Herr Schäfer, of Dessau, Herr Zollikofer, of St. Gall, and Professor Drehschmidt, of Berlin. The remarks of the latter on inverted burners, as well as our own observations, lead to the conclusion that the inverted gas-burner has not found so much favour with the German as with the English public. We believe this is, in a measure, due to a relatively more perfect type of burner having been brought to the fore on the English market, while bad types were, and are still, being pushed in Germany with all the wiles of irresponsible advertisers. It will be some time before the German public recovers from the bad impression thus obtained of inverted burners; and their general adoption will have been thereby greatly retarded.

A Departure in Gasholder Construction.

We publish elsewhere a description, with illustrations, of the gasholder the designs for which were the subject of a paper read by Mr. J. van Rossum du Chattel at the International Engineering Congress held at Glasgow in 1901, and which has since been constructed at the Municipal Gas-Works in Amsterdam. Although by no means of a large size, it possesses some features which are of more than ordinary interest, and claim for it special notice. It is the largest gasholder hitherto constructed after the patent of Professor Intze—a description of which was given in a paper by the inventor at the meeting of the (then) Gas Institute in 1885. This method of construction appears to have been decided upon owing to the conditions under which the work had to be undertaken; it being held that the indifferent nature of the ground, with the natural water level less than 5 feet from the surface, and the consequent high cost of a good foundation, made it necessary to reduce as much as possible the total weight, and to preclude a tank made of brickwork or concrete. It was requisite also to use piles in order to obtain the necessary stability; and these, it appears, varied in length from 40 to 60 feet, the average length being about 47 feet. An annular foundation of these piles, which numbered 2764, was formed, on which was laid a wooden floor and a concrete annular disc, strengthened by sixteen iron beams. On this foundation has been built an annular brick wall about 23 feet high, having forty openings of sufficient size to permit the passage of a railway. The top of this wall is covered with a layer of asphalte, upon which the wrought-iron annular tank is placed. Thus a clear space is afforded underneath the tank and gasholder, with ample head-room for the storage of material and the working of railway sidings.

Whether or not the gain in these respects is worth the extra expense which such a system of construction is certain to entail, can only be accurately determined by a comparison of costs, for which no material is given in the description. There are, however, sufficient data in it to enable the engineer to form a fair idea of the weight of material required for a tank of the kind; and a comparison between this and that which suffices when ordinary methods are followed would be a very useful exercise for any student of engineering. But however valuable land may be in this country, it has never been regarded as sufficiently so to justify placing gasholder tanks in mid-air, instead of below ground. At the same time, pile driving for foundations of any kind is very rarely necessary in this country. Where, as in this case, it has to be resorted to, exceptional methods of construction can scarcely be avoided. It is not, however, easy to understand why such an expensive design should have been adopted for the inner wall of this tank, which is formed of a series of heavy staunchions with buckle plates between, instead of Intze's circular dome, or even of that which is most usual—namely, continuous plating. Moreover, although the total weight of the structure is, it is true, greatly lessened by the considerable reduction effected in the volume of water required, yet the actual weight upon each square foot of annular foundation is not lessened, but is really much in excess of what the weight on each square foot of foundation would have been had the ordinary method of construction been followed. We refer, of course, to the ordinary wrought-iron tank resting upon a foundation of corresponding area.

The gasholder is a four-lift one; the inner lift having a diameter of about 190 feet and a depth of about 32 feet, which is rather shallow for such a diameter. It is noticeable that tangential rollers are employed for guiding the lifts, although these are seldom used in this country except for the largest-sized holders, and even for these opinion as to their necessity is divided. It will be recollected that a discussion ensued upon this point at the very last meeting—namely, in 1902—of the Incorporated Institution of Gas Engineers (now happily merged into the Institution of Gas Engineers), following upon a paper read by Mr. (now Sir) George Livesey, on the "Development of the Gasholder." Mr. Charles Hunt then expressed himself as being in doubt with reference to them; and the late Mr. William Foulis stated that for gasholders constructed by him having a diameter of about 280 feet, he had come to the conclusion that it was not advisable to use tangential rollers. Moreover, as a result of his experience, he would have no hesitation in constructing larger holders with radial rollers only. It is satisfactory to find in the guide-framing of this gasholder an example of the rapidly-growing practice of discarding heavy and showy construction, and the adoption of the more modern English practice in this regard. It need not be forgotten that this country, whatever may be its shortcomings in other respects, has been foremost in gasholder construction, and is not, it may be hoped, destined as yet to lose the lead, either in point of size or simplicity of design.

Liability for Forged Transfers.

Happily it is not a frequent occurrence that the Law Courts are called upon to deal with a case of forgery in respect of a transfer of stock which has been so successful that the question at issue is which of two innocent parties ought to bear the loss occasioned by the malfeasance. But such a case, as our readers have been made aware by previous references, has arisen, and was last week finally determined, between the great banking-house of Barclay and Co. and the Corporation of Sheffield. All joint-stock companies and all municipal corporations are concerned in it; and it will allay any feeling of uneasiness that may have possessed them over the matter to learn that the highest Court in the land completely exonerates them in the event of such an untoward event happening to them under similar circumstances. The gravity of the matter is not found in the frequency of such occurrences, but in the serious liability to which such a forgery (had the case ultimately gone against the Sheffield Corporation) would have exposed all municipal bodies and joint-stock companies, and in the incessant anxiety which would have rested upon them by hitherto unsuspected obligations other than the duties devolving upon them by their Private Acts in registering transfers of stocks or shares and issuing fresh scrip.

The importance of the case cannot be better impressed than by a brief recital of the facts. The action was brought to recover £11,487, but the total amount involved was upwards of £14,000—the Sheffield Corporation having also paid £2524 for dividends and interest, and £318 in costs. The forged transfer had reference to the Corporation Three-and-a-Half per Cent. Irredeemable Stock. An advance was made by Messrs. Barclay and Co. on what purported to be a transfer of £8200 of this stock. They took the transfer from their customer as security, and were satisfied. Coming from a banking-house of such repute and influence, the Corporation at once complied with their request that it might be registered and new certificates issued. But as a matter of fact, the Corporation, as the Lord Chancellor last week pointed out, have no machinery to inquire into the transaction out of which the transfer arose; while the bank was at liberty to lend their money or not, and could make any inquiries they chose. The next step was the sale of the stock by Messrs. Barclay and Co.'s customers; and in the transfer to the purchasers, Messrs. Barclay concurred. The discovery of the forgery came about in this way: Originally the stock was registered jointly in the names of two persons—Timbrell and Honeywell. Some few

years passed after the transfer, and Timbrell died; and not until then did Honeywell discover the existence of the transfer, and alleged forgery of his signature. Law proceedings compelled the Corporation to make good the loss to the true owners of the stock; and the Corporation in turn instituted an action to obtain an indemnity from Messrs. Barclay and Co. No suggestion of any negligence was even imputed, or want of good faith; but it was suggested that Messrs. Barclay and Co. warranted to the Corporation the genuineness of the transfer. The case first came before the Lord Chief Justice, whose judgment was favourable to the Corporation; the Court of Appeal reversed the decision; and now the House of Lords has confirmed the judgment of the Lord Chief Justice. It was considered by the Lord Chancellor and Lords Davey and Robertson that, both upon principle and authority, the Corporation were entitled to recover.

The decision sets at rest the important issue as to which of two innocent parties should bear the loss ensuing upon the forgery of a transfer under like circumstances; and the relief is on the side of municipal authorities and joint-stock companies. Justice has been done. If the final decision had upheld the view of the Court of Appeal, the liability it would have cast on both authorities and companies would have been an onerous one; and prompt dealings in stocks and shares would have been rendered absolutely impossible, even where there was nothing to excite suspicion.

The Testing of Coal for Gas-Making Purposes.

By a rather singular coincidence, the above subject—which is one of interest to every gas manager—has come into unusual prominence in three succeeding issues of the "JOURNAL." On the 27th ult., we described the new coal-testing plant erected for the Birmingham Corporation to Mr. Hack's plans; last week we furnished particulars of those designed for the German Gas and Water Association; and to-day we give a translation of a lecture delivered by M. Sainte-Claire Deville, the Chief of the experimental works of the Paris Gas Company, to the pupils at the School of Mines, in which the whole process of testing gas coals, as carried on under his supervision, is explained in great detail. The publication at so close an interval of two descriptions of experimental gas-works and of a discourse on the testing of gas coal by one of the greatest masters of the subject, is, we venture to think, unique in the history of gas journalism. It affords an opportunity to students, and even to those who have passed beyond this stage, of extending their knowledge of a branch of their work upon which carbonizing results—those obtained in the retort-house—in a very great measure depend. A laboratory test of coal is better than nothing; but a test on a manufacturing scale is infinitely more valuable to a gas manager. Hitherto, as will be seen from the account of the new plant already given, Birmingham has been satisfied with tests limited to 56-lb. charges carbonized in iron retorts, and possibly with only a few general results. Henceforth they will be much more comprehensive, and furnish the fullest information on all the materials dealt with. This is exactly what is done in Paris, as will be seen from the outline given by M. Sainte-Claire Deville of the report which has to be made on each test. He has done some exceedingly good work at the Company's experimental station at La Villette, where between 1887 and 1898 no less than 1812 tests of coal were made, the results of which are given in a condensed form in a table which will be found at the end of his lecture. Where necessary, they have been rendered more intelligible to readers on this side of the Channel by the conversion of the figures into English measurements. These coal-testing plants are not on a laboratory scale, but are in reality small gas-works. Those at Birmingham are equal to the production of 250,000 cubic feet per day; while the Paris works could turn out daily more gas than could be consumed by the population in many French towns rejoicing in a Sub-Prefect and a Court of First Instance. The experimental works of the German Association, which are situated at Carlsruhe, in close proximity to the municipal gas-works, will confer on the smaller gas undertakings the advantages possessed by the larger ones in the matter of obtaining reliable tests of coal. Reverting to the lecture, we think the pupils at the School of Mines were fortunate in having an opportunity of receiving instruction in coals and their testing from such a master as M. Sainte-Claire Deville; and while congratulating them thereon, we may express our pleasure at being able to convey that instruction, through the medium of our translation, to a far larger number of students than it would otherwise have reached.

Large Gas-Engines and their Fuel.

Those of our readers who have given much attention to the use of gas for the production of power cannot fail to have been struck by the progress made of late years in the construction of motors for utilizing it. Since Lenoir took out his first patent in 1860 for what was in reality the pioneer gas-engine—which some who peruse these lines may possibly have seen at work at the Exhibition of 1862—what changes have been effected. Eight or ten years ago a movement was initiated which had for its object the utilization of blast-furnace gas in engines of greater strength than those previously employed; and the outcome was the magnificent 600-horse power engine shown by the Cockerill Company, of Seraing, at the Paris Exhibition in 1900. This, however, was surpassed the following year by one of twice the power, which was itself eclipsed by the splendid engine shown by the Deutz Company at the Düsseldorf Exhibition in 1902. At Liége, as will be found from the account given elsewhere of the interesting gathering of members of the Belgian and French Gas Associations which took place in that town last week, the gas-engine is very much in evidence; and it is a power producer which gas managers will do well to regard at its real worth. True, these large motors are constructed to utilize producer and blast-furnace gas; but, as is well known, this is not so pure as the article generally supplied. This is acknowledged by no less an authority than M. Mathot, some extracts from whose valuable paper, recently read before the Institution of Mechanical Engineers, will be found in another part of the "JOURNAL." While directing attention to the remarkable growth of large gas-engines on the Continent, he indicates the difficulties which have still to be overcome in order that they may work safely and with facility of control and upkeep; and towards the close of his communication, he lays special stress on the importance of the purity of the fuel as a factor in their proper action. It is to attain this that, in his opinion, the efforts of experts should be directed. But it may be remarked that in ordinary coal gas the quality lacking in the other fuels is a conspicuous feature; and the only impediment to its more general use appears to be its price. The aim of gas suppliers should therefore be to make it as cheap as possible; or, as has been pointed out on several occasions recently, to send out a gas suitable alike for lighting and power purposes at such a figure as shall render it preferable to all its rivals. If the user of power can get at reasonable cost all the gas he requires from the mains in the street, he will not be inclined to go to the expense of putting in separate plant for its production.

Further Corporation Results.

We publish this week a further batch of results of the operations of corporation gas undertakings during the past financial year; and, as is usually the case, there is no lack of satisfactory features in them. Taking Belfast first, with a small increase in the output, the net profit is a great deal larger than for the previous year, in spite of the fact that, by an alteration in the rate of discount, the consumers have gained to the extent of £4000 within six months. The make of gas per ton shows a large increase on the present occasion; while the net proceeds of the residuals are equal to over 89 per cent. of the cost of the coal. In connection with the latter figure, it may be noted that the following were the proportions of coal and oil gas sent out during the past year: Coal gas, 54·897 per cent.; water gas, 45·103 per cent. Brighouse is able to show an increased make; but unfortunately it was much more than absorbed by the large addition which took place to the unaccounted-for gas. This loss will, however, doubtless be curtailed as soon as possible, and it is also to be hoped that the heavy reduction in the price realizable for coke will prove to be very short-lived. In spite of the drawbacks named, the accounts for the past year show a very substantial balance on the right side. The profit realized at Hereford is sufficient to warrant a reduction

in price to 2s. 6d. per 1000 cubic feet net for all ordinary purposes and 2s. 3d. for engines, after allowing for a contribution of £1000 in aid of the improvement fund of the city. It is interesting to note that, since the works were acquired by the Corporation in 1872, there has been an almost uninterrupted increase in the output of gas; the production having risen from about 2600 cubic feet per head of the population in 1873 to 6200 feet last year. A matter which is receiving attention is the proportion of unaccounted-for gas, which stands at the substantial figure of 10·42 per cent. Ilkeston shows a very slight falling off in the quantity of gas made; but the balance at the end of the year was only £300 less than that for the preceding twelve months, while a reduction of 2d. per 1000 cubic feet in price affected the rental to the extent of over £800. The competition of the electric light with gas is particularly keen at Ilkeston (the former undertaking being also in the hands of the Corporation); and, in view of this fact and badness of trade, it is highly satisfactory to find that gas is practically holding its own. Ordinary consumers have been showing a decided tendency to decrease; but users of prepayment meters are taking their place, with gratifying results so far as the profits are concerned. Kendal also exhibits an infinitesimal falling off in output; the decrease in income being practically accounted for by a reduction of 3d. in the price of gas. The sound condition of the gas undertaking is emphasized by a heavy deficiency on the municipal electricity works.

In connection with the Longton Gas-Works, there are one or two points that may be noted. In the first place, the unaccounted-for gas has been reduced to the remarkably low (for a mining district) percentage of 5·4 of the make. The same feature is to be found here as at Ilkeston; the ordinary consumers having somewhat fallen off in numbers and in consumption per meter, while the prepayment meter users show an increase in both respects. Prevailing industrial conditions, of course, explain the smaller consumption by the big consumers; but, in spite of this, the profit was only £832 less than the preceding year, while all extensions and alterations during the twelve months (including £1000 for water-gas plant) were paid for out of revenue account. Stafford is in the happy position of being able to report a fair increase in the output of gas; while the manufacturing operations have produced many fresh "records" for the town. First of these may be mentioned the make of gas per ton, which is over 1000 cubic feet above the previous highest; while the sale per ton is 730 feet more than the best figure hitherto realized. Other "records" are to be found in the quantity of sulphate of ammonia produced; the net proceeds of residuals (equal to 83·6 per cent. of the cost of coal); carbonizing wages; coal and working expenses, less residuals and miscellaneous receipts; and gross profit. The results attained are, of course, highly creditable, especially when it is remembered that they have been secured without the aid of any machinery whatever in the retort-house. We cannot complete our reference to Stafford without drawing attention to the profit-sharing scheme that exists in the gas and electricity works there. As already reported in the "JOURNAL," the gas workers have received a bonus on the past year's operations equal to 7½ per cent. on the wages paid, and the men in the electricity works one of 5½ per cent. These distributions are, as is only natural, keenly appreciated by the employees.

Rating Gas-Mains at Melbourne.

The Metropolitan Gas Company of Melbourne are to be congratulated on the result of the final proceedings in the litigation in which they have been for more than two years engaged with the Board of Works on the subject of the rating of their mains. Shortly stated, the question submitted to the Court of First Instance was whether the Board were authorized to levy rates on the Company in respect of mains comprised and separately valued in the valuations of the several Municipalities within which they were situated; and, if so, whether the mains were to be treated, for rating purposes, as "sewered" or as "unsewered" properties. A perusal of the report in our "Legal Intelligence" to-day will enable our readers to ascertain for themselves how far gas-mains come under one or the other description. Suffice it to say here that property comprised under the former heading is liable to be rated up to 1s. in the pound on the net annual value, whereas the other kind is let off for 2d. or even 1d., according to situation, with exemption after nine years from the passing of the Act authorizing the rate. The first decision was against the Company; but it was reversed on appeal. Thereupon the Board sought the opinion of the Judicial Committee of the Privy Council, but, as will be seen, with not much success. The conclusion arrived at is that the Company's mains are not sewered properties, inasmuch as they do not abut on a street which has been sewered, and that consequently they must come within the other category. Their Lordships recognized that gas-mains, from their very nature, are incapable of deriving from sewers the same benefit as houses intended for habitation; but they did not consider this was a sufficient reason for placing them in a new category not recognized by the Act, and so relieving them altogether from rating. The Company, however, will probably not complain at their Lordships' decision.

The Institute of Directors.

Men engaged in commercial enterprise owe a good deal to Lord Avebury for his efforts on their behalf. Last week we referred to a long address delivered by him as President of the Industrial Freedom League; and now we find him occupying a similar position at the second annual general meeting of the Institute of Directors—an organization to which reference has already been made in the pages of the "JOURNAL." Satisfaction was expressed by his Lordship, when he rose for the purpose of moving the adoption of the report, at the increase of membership that had taken place during the year; and he announced that the Council had determined to apply for a Royal Charter, which, if granted, would tend to strengthen the position and influence of the Institute. He stated that among those who had already joined were gentlemen belonging to, and representing, many of the banks, insurance offices, and railway companies, as well as commercial and manufacturing concerns; but they desired the support of an even greater number of members of this character, not on account of any direct personal advantage to themselves, but because of the weight which their position gave in matters connected with the City and with other parts of the country. There were, he pointed out, many matters in connection with the law of limited liability companies and their management, as well as the principles which regulated the conduct of such companies, which could be much better dealt with by some such body as the Institute. But, of course, if it were really to be successful in these important aims, it must have a general backing among the commercial community, so that any action taken would carry due weight. There was no other organization which covered exactly the same ground as the Institute of Directors. There were societies which dealt with some particular aspect or part of business, but not with the conduct of commercial concerns as a whole; and it was from this point of view that he had felt from the beginning that the Institute might fill very valuable functions. In view of the tendency there is nowadays to form businesses of all kinds into limited liability companies, there is no reason why Directors, like other professional and commercial men, should not have an Institute of their own; and Lord Avebury is doubtless right in the opinion that there is much important work that such a body may perform.

Unrest in South Wales.

Everything seems to point to the fact that the South Wales coal trade is in for another spell of labour trouble. It is as yet too early to form a decided opinion as to the probable extent of the disturbance; but so far both masters and men appear to be inclined to adopt a strong attitude. An incident took place at the Bwllfa Colliery early last week which shows that at any rate the former are not inclined to be dictated to. The men (numbering about 1300) some days previously came out on strike in consequence of the presence of a number of non-Unionists; and when all had been induced to join the Miners' Federation, the men waited on the Colliery Agent with a view to arranging for a resumption of work. To their dismay, however, they were informed that, as the Company had been obliged to refuse a heavy contract owing to the action of the men, they could not at present be permitted to start work again. Thus was the war carried into the enemy's camp. At some other collieries also he non-Unionist difficulty has cropped up; and under these

circumstances it is not surprising that attention has again been given to the question by the men's leaders in their public utterances. Speaking at Mountain Ash, Mr. W. Abraham, M.P. ("Mabon"), said they had an agreement with the employers; and they, as representing the Miners' Federation, wanted to confine it to the men whom they actually represented. The employers, however, thought differently, and made it a condition that they should become responsible for all the men employed; and having done this, he maintained that the employers were morally bound to help them in getting the men into the Federation. The employers were now doing what was unfair towards them. Having been compelled, as Federation leaders, to accept responsibility for, and also to pay money on behalf of, non-Unionists as well as Unionists, they had a moral right to compel every single man employed in the collieries to join the Federation. "Mabon" expressed a doubt that the employers would agree to a policy which would lock-out Federationists who occasionally stopped the collieries because they refused to work with non-Unionists—on the ground that "the absurdity of the thing carried with it its own condemnation." Events may prove this optimism to be justified; but the masters can hardly be blamed if they forcibly object to this ruinous method of "persuading" men to join the ranks of the Federation.

A Check to Municipal Speculation at Torquay.

Torquay is to be saved from itself, whether the members of its Town Council will or not. The Local Government Board have again informed the Council that they do not approve of the proposal to erect new electricity works, in fulfilment of the undertaking to supply current to the Company who have obtained power to lay tramways in the town. In these circumstances, there is nothing now for the Corporation to do but to rid themselves as best they may of the obligations into which they have entered with the Tramway Company. Some members of the Council, who look with eager expectation to visions of profit to be made out of the sale of current to the Company, are disposed to resent the action of the Local Government Board. One of them characterized the proceedings as "extraordinary in the extreme;" and some feeling was displayed against a Councillor who had taken the precaution to see that the Board were fully informed of the facts. While allowance must be made for the feeling of annoyance of men who witness the failure of their plans, it is not likely that advantage will accrue to the Corporation from mere antagonism to the Board. It is true the Department has not interfered so often as it might to prevent local authorities from carrying out schemes that are calculated to involve a serious loss to the ratepayers. In this case it has good ground for doing so. The whole undertaking, on the part of both the Company and the Corporation, is of a speculative character; while as regards the Corporation's electricity works, it means the absolute loss of some thousands of pounds spent upon the present station and on plant which would have to be discarded if the new scheme was carried out. If the Dolter Tramways Company have faith in their scheme, there is no reason why they should not carry it out, seeing that they have parliamentary sanction for it. But so far the Corporation have certainly failed to prove that the ratepayers ought to take any share of the responsibility for its success; and those who have the true interests of Torquay at heart must be grateful to the Local Government Board for putting a check upon the trading propensities of the municipal authority. When it is once clearly understood that the Corporation are unable to fulfil their part of the bargain, they will probably have little difficulty in coming to terms with the Company. If the Corporation cannot supply current, the Company must erect their own works. Whether in doing this they may be able to reverse the position, and have the Corporation for a customer, instead of being a customer of the Corporation, will probably depend upon the attitude which the Electric Lighting Committee of the Town Council take up.

Sir Benjamin Hingley, the Chairman of the Cradley Heath and South Staffordshire Mond Gas Companies, whose death was announced in the "JOURNAL" for the 23rd of May last, left estate of the gross value of £158,696, of which the net personalty has been sworn at £88,089. The shares of deceased in the Cradley Heath Gas Company are bequeathed to his nephews and nieces and to his brother Joseph.

WATER AFFAIRS.

Payment for Water by Measure.

THE first appearance of Mr. George O. H. Klopp with a paper before the British Association of Water-Works Engineers was, if we remember rightly, that which he made at the recent meeting at Hastings; and the opinion may be permitted that the day is somewhat distant when he will again venture to submit to the members the subject for discussion with which he approached them on this occasion. The title given to the paper was of ponderous character, and completely obscured the important subject. It was not until quite two-thirds of the paper (which two-thirds consisted of algebraical equations and an amount of hypothesis) had been waded through that its real point was met with. Then the author told the experienced water-works engineers and managers before him what they all know only too well, that the present method of assessing domestic water supplies on the rateable value of houses is one which leads to all manner of difficulties, and is certainly inequitable in many instances. However, though water-works administrators have been for many a long day looking about for an improved method of charging, they have never been able to discover anything better with which to displace the present system. But Mr. Klopp (who has a living interest in water-meters) has at hand a ready remedy for all such inequalities and difficulties. His suggestion is to allow a minimum supply per head of, say, 30 gallons per diem, charge for this minimum (on a sliding-scale if desired), and also a *pro ratâ* sum per 1000 gallons for any excess. Mr. Klopp is to be congratulated on the fact that the very crudeness of this suggestion, and the ill-considered and pedantically stated case on which it was founded, produced a fine discussion and completely destructive of all that was in and under the paper.

Mr. Klopp's proposal, of course, resolves itself into a supply by meter, with the complications previously referred to, of a minimum to be charged for on a sliding-scale if necessary according to the rateable value of the house, and then a *pro ratâ* sum for excess consumption. Supply by meter means a big capital outlay, a considerable annual charge upon that capital, an expenditure for maintenance and depreciation, a material increase upon the expenses of administration, and a menace to the health of the people; and all for what purpose? Perhaps to save an amount of waste which can in great part be saved by less expensive methods. There would be large outgoings by the adoption of Mr. Klopp's remedy for difficulties and inequalities; but certainly there would not be any financial gain. One has only to read the paper, and the author's comments on the discussion (which latter were alone a sufficient answer to the paper itself), to see that, under such a changed condition, the new state of the water suppliers would be worse than the old; for not only would their annual expenditure greatly increase, but their returns would, if the minimum supply were not to exceed present payments (as the author in his final remarks indicated was his idea), show little disposition to increase, for most people would take care to keep within the minimum. The discussion uprooted every one of the points in the case for a general meter supply. There is nothing comparable between this country and America, though Mr. Klopp tried to draw from across the Atlantic lessons for application at home. Where is the advantage in pointing out that in the States there has been considerable saving in waste through the adoption of the meter system when perhaps the worst figure per head per day that can be quoted under our system of free use and payment by the present method, is better than the best figure to which consumption has receded through the use of meters in the American towns which are commonly quoted in this connection?

In his reply, too, Mr. Klopp evaded a large amount of the discussion by pointing out that the last paragraph of his paper commenced with the words: "Under existing condi- "tions only trade and mixed supplies can be treated in the "manner the author advocates." That was a conveniently placed line of escape; and it cannot be regarded as anything else, seeing that the proposal offered for discussion was introduced by the author submitting that the present method of assessing domestic water supplies on the rateable value of houses is one that leads to all manner of difficulties, that it is not equitable, and that there is one method

of overcoming these troubles. That one method is the author's, and that the members declined to accept. It will thus be seen that, if the whole question had not been the subject of debate, there would have been no particular purpose in the paper. But, after all, the water-meter that engineers will be prepared to label "reliable" if not "perfect" has yet to be invented, so said every speaker excepting the author of the paper during the discussion. And so said, too, the President in his Inaugural Address. Truly, Mr. Klopp was in very unsympathetic company on this occasion.

The End of a Great Arbitration.

When the Arbitrators under the Metropolis Water Act, 1902, made, in November last year, their award in the outstanding case of the New River Company—giving them £6,534,000 instead of the £11,660,000 claimed—they practically finished their labours, though it was quite expected that points of difference might subsequently arise which would necessitate recourse to their assistance. The expected, as will be seen from a report which appears elsewhere, happened; and last week Sir Edward Fry and his two colleagues (Sir Hugh Owen and Sir John Wolfe-Barry) found themselves once more in the hall of the Institution of Mechanical Engineers adjudicating upon matters connected with the transfer of the undertakings of the Water Companies to the Metropolitan Water Board. After the transfer had taken place, Mr. Allen Stoneham, the Government Auditor, disallowed certain items, totalling to about £100,000, charged by some of the Companies in their accounts, and in regard to which the Board declined to admit liability. The first question arose as to the expenses incurred by the West Middlesex Company in defending their claim to £70,000 of their reserve fund for division among the shareholders. This claim was sustained by the Court of Appeal, but rejected by the House of Lords; and Sir Edward Fry supported the Auditor in his refusal to put these costs upon the Board. He said they had nothing to do with the maintenance of the undertaking, but were a "luxury" which the Company had thought fit to indulge in; and, consequently, they must pay for it. The East London Company were the next to be heard by the Arbitrators in support of their claim for about £3000 paid to the Chamberlain of London, £17,285 for "sundry stores," and £21,419 for "water in store" at the time of the transfer. Seeing that the amount to be paid to the Chamberlain's sinking fund was only ascertainable at the end of each year, and that this time had not arrived, the Auditor's action was declared to be wrong. On the other points, however, his ruling was sustained by the Court. Mr. Balfour Browne adduced some forcible arguments in support of the Company's contention that both stores and water were their property on the day of the transfer; but Sir Edward Fry insisted that they were parts of a going concern, and that the undertaking handed over could not be "denuded" of them. This decision applied equally to the Lambeth and Southwark and Vauxhall Companies. The parties came to an agreement upon the figures in regard to the liquidation costs; and with a few complimentary remarks on all sides, this protracted inquiry—which had extended over about sixty days, exclusive of some sittings in chambers—was brought to a close. Speaking on behalf of the Water Board, Mr. Fletcher Moulton said that the decisions of the Arbitrators on one of the most complicated problems ever submitted to a tribunal had, on the whole, "given the most "complete satisfaction to all parties." As Mr. Du Cane, representing the Water Companies, expressed hearty concurrence in these sentiments, we may take it that they represent the prevailing feeling. We will only add that "all's well that ends well."

A Case for Government Compensation.

The Torpoint Urban District Council will, we think, have little difficulty in making out a good case for the sympathy of the Admiralty in the unfortunate position in which the Council are placed by the failure to secure the passing of their Water Bill. Upon the Government undoubtedly rests the responsibility for both the promotion and the loss of the Bill. When the scheme was undertaken, the Admiralty had in contemplation the erection of a large establishment for use as a gunnery training school within the Torpoint district; and it was principally with the object of providing a supply of water for this contemplated building that the Council embarked upon their ambitious water scheme. It is true that the supply of water to Torpoint might with advantage be improved; but something on a much more modest scale than that which was attempted this session would satisfy the ordinary needs of the urban district for many years to come. Unfortunately for the Council, a change came over the policy of the Admiralty between the time when the scheme was initiated and the period of its presentation to Parliament. Retrenchment was applied to the expenditure; and among other schemes abandoned, modified, or postponed was that of the Torpoint gunnery school. Very much to the surprise of members of the Council, who had no hint that great changes were in contemplation, they found themselves without the expected Government support in the Parliamentary Committee-room; and the Bill was rejected. In the circumstances, this is perhaps matter for congratulation rather than otherwise. It is true it places upon the district the liability to pay costs which are overwhelming in amount for so small a community. The case would, however, have been worse if the Bill had been passed and the works wholly or partly carried out before the Admiralty changed their mind. As matters stand, the District Council can with good reason appeal for aid from the National Exchequer in the discharge of their liability. In the other case, they might have found themselves struggling for a generation or two under a crushing burden of debt, with no hope of relief, except for another possible change in the policy so far pursued by the Admiralty.

Presentations to Mr. R. Seymour Benson.

The official staff of Messrs. Ashmore, Benson, Pease, and Co., Limited, of Stockton-on-Tees, assembled in the large drawing office at Parkfield Works last Friday week, for the purpose of saying "Good-bye" to their Managing-Director, Mr. R. Seymour Benson, who, as already recorded in the "Journal," has resigned this position, and severed his connection with the firm. After a few brief but well-chosen remarks by the Works Manager (Mr. Beard), a handsomely engraved and massive solid silver tray was presented to Mr. Benson by Mr. Albert Jeynes (the oldest member of the staff), on behalf of the officials. Mr. Benson expressed the great pleasure it gave him to accept so splendid a token of good-fellowship, at the same time regretting the fact that old associations were to be severed. He spoke highly of the staff as a whole, and said he should never forget the way in which he had been faithfully served and assisted by everyone present. He hoped that the future would be as full of pleasant work as the past 25 years had been, and that each one would strive to help the other, and so assist the general welfare of the Company. Mr. Benson named several of the staff who had been with him during almost the entire period of his directorship, and again heartily expressed his thanks for the handsome gift, which, he said, he should always look upon with pleasurable recollections. Immediately afterwards, a deputation of the workmen presented Mr. Benson with a valuable silver fruit-dish suitably engraved. The presentation was made by Mr. Tom Ray, the oldest workman in the establishment, who remarked that this was the hardest job he had ever had to do. Mr. Benson then addressed the men, and echoed the words of Ray that, if it was hard to give, it was also hard to receive, because it meant that old friends were parting; but it was none the less a pleasure to accept such a token of respect from the best set of men master ever had to serve him. The Stockton official staff, numbering about 72, were afterwards photographed with Mr. Benson, to whom it is intended to present an enlargement.

North British Association of Gas Managers.—The programme for the forthcoming annual meeting of the North British Association of Gas Managers (the forty-fourth) has been issued by Mr. R. S. Carlow, the Secretary. The meeting is to be held in the Great Hall of the United College, St. Andrews, on Thursday, the 20th inst. After the usual preliminary business, the President—Mr. J. W. Carmichael, of Barrhead—will deliver his Inaugural Address, and the following papers will be read: "Some Aspects of the Commercial Management of Gas-Works," by Mr. A. Yuill, of Dundee; "Gas for the House," by Mr. W. B. M'Lusky, of Perth; and "Competition of To-Day," by Mr. Allan Reid, of Brechin. The members and lady friends will dine together in the Cross Keys Hotel in the evening. On the following day, the forenoon will be devoted to visiting various places of interest in the ancient University city, such as the Cathedral, the Castle, St. Leonard's Chapel, the University, the Trinity or Town Church, and the Links. In the afternoon there is to be a circular drive in the neighbourhood; the route including, among other places, Magus Muir and Dura Den.

NOTES FROM WESTMINSTER.

So far as proceedings connected with Gas Bills are concerned, the session may now be said to have ended. Discussion over the London Gas Bill has finished; and upon the position more is said in succeeding paragraphs. The only other Bill incorporating gas clauses that was considered during the week was that of the Matlock Bath Council, providing among other things for the compulsory removal of the gas-works within the next seven years. Just, however, as the section of the measure left the Lords Committee, so it has passed the Police and Sanitary Committee of the Commons. The only other matter in which readers will be interested arises on the Gravesend Electric Lighting Order, which was opposed by the Northfleet and Greenhithe Gas Company, the Gravesend and Milton Water Company, and the Gravesend and Milton Gaslight Company. This Order is to obtain parliamentary sanction to one of the most pernicious forms of municipal trading, and that is the carrying on of the business of electricity supply in the district of a neighbouring authority, who though they have electricity supply powers themselves have not thought it wise to put them into operation. The opponents, in their own defence as ratepayers and in two cases as competitors, sought to overthrow the Order, but were unsuccessful in sufficiently opening the eyes of Earl Lauderdale's Committee to make them see the very probable injury that the proposal infolds for the unsuspecting ratepayers of Gravesend. Perhaps this Order explains the fineness with which the expenditure of the Electricity Department was cut in their recently issued accounts, to show the modest balance of a few pounds on the past year's working—without putting anything aside for reserve or depreciation. Upon the peculiarities of these accounts, comment was made in last week's "Electric Lighting Memoranda." The opponents, unsuccessful on their first point, urged the insertion of the Northumberland clause; and last year's accounts, with the proposed further speculation, ought to have been sufficient to have gained them this protection. But their Lordships could not see it. The vacillation of the Board of Trade and Parliament over the insertion of the clause is something that passes the comprehension of ordinary mortals.

The Testing Question. An hour last Tuesday morning disposed of the London Gas Bill; and the testing question was settled—perhaps only for the time being—in the manner that had been foreshadowed in our editorial columns. The Metropolitan gas industry was strongly represented in the Committee room during the short discussion—both directorially and officially. Sir George Livesey was there, with Mr. John Ewart representing the Board of the South Metropolitan Company. Mr. W. G. Bradshaw, the Chairman of the Commercial Company, and with him were noticed Mr. H. E. Jones and Mr. Walter Hunter. Mr. Charles Hunt, who has taken a place among the foremost of those who have been identified with this struggle, was also present; and most of the chief officials of the three Companies were in evidence. Among interested spectators were noted Mr. Vernon Harcourt (the Senior Gas Referee), Mr. R. O. Paterson, and Mr. Dibdin. Professor Clowes and other officials of the County Council were, of course, also in the room. It was known that the proceedings, through the agreement that had been arrived at on the matter of testing, to save the remainder of the Bill (which contained among other things the provisions as to the abolition of tests for sulphur impurities), would be little more than of a formal character. The position at which the matter was left at the former sitting of Lord Rosse's Committee is well known. The Committee had appreciated the vicious character of the test prescribed by the Departmental Committee, and which the County Council sought to perpetuate; and Mr. Vernon Harcourt's replies to a member of the Committee gave the death-blow to the monstrous proposal. The Committee decided that the existing tests should stand; and then came a threat by the Council's representatives to withdraw the remainder of the Bill, which the Companies naturally did not want to lose. The main feature of the settlement amounts to this, that the Gas Referees are to be empowered to prescribe a burner in which the 14-candle gas, when consumed at the rate of 5 cubic feet an hour, shall produce a light equal in intensity to 14 candles. The Gas Referees will hardly look kindly upon this addition to their duties, nor upon the unnecessary multiplication of standard burners—for 14-candle gas is not the end of the journey. Sir Ralph Littler, when making the announcement to the Committee as to the agreement and its nature, almost pictured it as a great piece of condescension on the part of the County Council; but the officials of the Council know full well that they have been badly beaten, and that the Companies have scored heavily off them. After the evidence of the Senior Gas Referee confirming the grievance of the Metropolitan Companies and of the gas industry at large, it will be difficult for them to excuse their action, advice, and testimony; and the nearest they could approach to a semblance of success was to displace the present method of testing as prescribed for 14-candle gas in London (which Mr. Harcourt described as being the "preferable" method) by one which should retain the 5 cubic feet rate of consumption, by having different burners for each quality of gas. That is a poor result, as these official advisers know better than those they serve. "Greater liberty" is what the gas industry has been asking; and the County Council have given it to the 14-candle Gas Companies of London with a forced liberality to save the 5 cubic feet rate. If the Companies stick hard-and-fast to what has been given them, it will not be the Companies who will suffer. The Gaslight and Coke Company (whose position is now better than it was before in the matter of testing, as will be seen presently) and the Commercial Gas Company are both unlikely to take part in any future attempt to revise the test that has been given them; but for the South Metropolitan Company, it is impossible to speak definitely. Sir George Livesey, Mr. Carpenter, and all those who support them, have made no secret of their feeling that they do not regard the test under which they are about to come as a scientific one, and that they do not want anything more than their just pound of flesh. Whether or not time will modify the present feeling is another matter.

The Three Days' Test. The only point which was the subject of discussion was the question of the average of three days' tests, which was a concession to the Companies by the Commons Committee in passing the test as originally proposed by the Departmental Committee and the County Council Bill. Sir Ralph Littler asked for the concession to be expunged under the altered condition of things; but Mr. Balfour Browne for the joint Companies opposed it. For liberty's sake, we are glad that Sir Ralph was not successful; but at the same time we are not sure that he was not right in requesting it, seeing that—there can be little doubt about it—it was given by the Commons Committee to help the Companies over the stile under the condition the question of testing left them. The Committee were of opinion that there was a little too much freedom about the provision; but they allowed it to remain, with the addition of words which will bring a company under a penalty if on any one day the deficiency exceeds 1 candle. The Committee were anxious that there should be steadiness in the quality of the gas supplied during any three days. In this average of three days' tests, and in the allowance of a deficiency of a candle on any one day, all three Companies participate; and that is a gain the Gaslight and Coke Company secure by joining their forces with those of the other two Companies in contesting the County Council Bill, with its oppressive proposal, as originally introduced to Parliament.

The London Electricity Power Bill. It was an exciting time in the House when the Administrative County of London Electricity Supply Bill came up for second reading on Thursday night; and just as Big Ben had announced that the day had closed, second reading was given to the Bill by 198 votes to 158. But many who voted for it, no doubt merely did so in order that the details of the measure might be thoroughly threshed out in Committee. It is a long day since a measure of the kind has had for its prime-movers men so skilled in the art of parliamentary strategy as this particular measure. Lobbying and canvassing have gone on, John Burns says, "to an extent that would have made a Philadelphian lawyer blush;" the Board of Trade has been interviewed; and the interest of the greater part of the London Press has been secured in a remarkable manner, and in many of the papers it is noticed there has been payment for expensive advertisements. The promoters of the scheme have evidently much to gain and, to the same measure, much to lose. And by the time the Bill came on, many members of Parliament had been worked up to such a pitch of animation over the matter that they had apparently formed the belief that the promoters were of the most disinterested and philanthropic of people, and even the Board of Trade had, through Mr. Bonar Law, several good words to say for the project. The whole scheme is wrapped in speculation and uncertainty; but yet the promoters talk of benefits of a marvellous character, as though they are already accomplished facts, keeping in the background all the disadvantages that ratepayers, the ordinary electricity consumers, and vested interests are likely to suffer through the competition. The much-applauded economic advantages can only result from a success which is as yet intangible; and, whether in the event it becomes tangible or not, those economic advantages must largely be discounted by the hurt that the competition will do. Consideration of the manufacturers is not by any means the only economic aspect of the question, when the existing large capital investment in electricity in London is brought into the account. Their advantage must be put into the balance against all the disadvantages to the far greater sections of the community. The Board of Trade appear to have made up their minds that for the manufacturers the scheme should be favoured; but they are unprepared to speak positively as to, in studying the manufacturers, an injustice resulting to a greater number. It is difficult to say definitely upon which leg the Board are standing. The Board themselves have been responsible for creating (and should now defend) the position of things which the promoters of the Bill are proposing to largely undermine. The Board have assisted in giving to the Municipalities of London almost carte-blanche in electricity trading; and now, in the discussion last Thursday night, Mr. Bonar Law advanced the argument that "this kind of business, which is speculative, can only be secured by extreme business push and energy, and by taking risks which local authorities ought not to take." Why has this not occurred to the Board of Trade before? It is precisely what the Board have been ignoring, and other people have been preaching, for years past. The Municipalities have been anything but prudent; and they have ridden roughshod in their anxiety to gain their ends. But this is not sufficient ground for the argument that the position should be further impaired to the additional detriment of

the ratepayers. Apart from the Municipalities, there are the existing Companies; and we look with some amount of apprehension upon the tendency of Parliament in these days to violate their own enactments, and to slight the protection which investors have felt they possessed in putting their capital and savings into enterprises which Parliament have assisted to bring into being. They are but idle talkers who say that the present electrical interests of London will be unaffected if the scheme goes through. London (whose capacity is not unlimited) will then soon be over-electrified; and it will not be an economic advantage if the millions of money invested and to be invested under this scheme cannot earn a fair profit as the consequence. The next stage of the Bill will be before the Committee over whom Sir James Kitson has been elected to preside; and the proceedings commence next Thursday. Again the Municipalities and the Companies will be found cheek by jowl fighting for the overthrow of this power and bulk supply Bill. Close on the day of second reading, the promoters offered to accept a purchase clause in terms to be left to the Select Committee. That was an excellent card for them to play; and no doubt it secured a number of votes—perhaps it saved the Bill, anyway for the time. A purchase clause, however, does not clear the ground.

ELECTRIC LIGHTING MEMORANDA.

Sound Advice from Edinburgh—The Nernst Lamp in Street Lighting—Variable Illuminating Power—Struggling for an Equality with Incandescent Gas Lighting, on Paper—Board of Trade Report on Provisional Orders—The Ascension of Power—News from Dublin.

The Incorporated Municipal Electrical Association have been meeting at Edinburgh under the presidency of Mr. Frank A. Newington, the Electrical Engineer to the Corporation. While his address cannot be described as a very brilliant piece of composition, it contains a great deal that showed the President's independence and soundness of view. In the case of a municipal electrical engineer, these two qualities—independence and soundness of view—appear to have a distinct relation to the financial productiveness or otherwise of his undertaking. The electrical undertaking of the Edinburgh Corporation is, of course, a strong one; and therefore Mr. Newington is able to take a breadth of view that some of his less fortunate contemporaries dare not take. The repayment of loans was one question dealt with; and it appears that the Association have come to the conclusion that about thirty years is the average life of electrical plant. The diverse character of electrical plant, and the rapidity with which it is often found that renewals are necessary, would almost, one would have imagined, have defied the striking of any general average. But there it is. The municipal engineers who have an interest in getting the best possible terms from the Local Government Board say about thirty years is the average; and no one need accept it who has any doubt on the point. It is fairly well known that the Local Government Board—who have now had excellent experience as to the position of many municipal electricity accounts and loans, and who have been learning that instances occur with too great a frequency of replacement being required, and no provision made for it, before the loan is paid off—have been shortening the repayment term; and naturally those who have to make things look as rosy as possible to-day do not like the additional present tax this puts on to the undertakings. The Local Government Board are not an institution existing for merely ratifying everything that municipalities think best or fancy; their functions comprise some attention to the interests of the ratepayers. Therefore we hope they will continue to exercise a wise discretion in this matter.

Another point in the address was the President's outspoken condemnation of the policy of sums being handed over to the rates until the reserve fund stands at the full statutory amount of 10 per cent. on the capital expenditure. Mr. Newington is evidently a humorist; and even where he drops into a jocose vein, we are able to seriously agree with him. Speaking of these transferences from profits to rates, he says: "Further, unless a similar sum is contributed by the gas undertaking, it is unfair. It does not seem right for the users of electricity to be asked to assist the users of gas to pay their rates." The boot is, as a rule, on the other leg; and it is the all too patient gas consumers who have to contribute largely to the rates, and, not only so, but also in many instances to the support of the electricity undertaking directly or through the public lighting. There are, on the other hand, comparatively few electricity undertakings that have sums of money they can afford to hand over to the rates; and if all were to adopt the golden rules of sound finance advocated by the President, there would be fewer still who would have anything to spare. What Mr. Newington says about electricity profits from his stronghold in Edinburgh is precisely what we have been saying about municipal gas profits long before anything in the nature of electricity supply profits were known. Under the circumstances, we can appreciate his little stroke of humour. Mr. Newington appeared at first to somewhat waver over the question of the formation of a depreciation fund; but finally he braced himself up for the expression of the conclusion that it seems sound business policy to form a depreciation fund over and above the reserve fund, in order to meet the emergency of some new form of artificial illuminant arising, and for balancing machinery put out of use through it being inconvenient or uneconomical to work. The President's counsel was later on reiterated by the Lord Provost of Glasgow (Sir John Ure Primrose, Bart.) at a luncheon given by the Corporation.

The President also made some candid admissions about incandescent gas lighting, which preface well a paper, written by the highly sanguine Mr. E. E. Hoadley, the Electrical Engineer of Maidstone. It was quite complimentary of the President to say that gas experts have "succeeded in very much improving the incandescent gas-mantle, so much so that it is now very suitable for the lighting of streets where a large amount of light is not necessary, and where therefore arc lamps" (we would add "and high-power incandescent gas-lamps") "would be too powerful. Just at present, there does not seem to be any form of electric lamp that can quite compete with the incandescent gas-mantle for this purpose." But Mr. Hoadley, in his paper, denies all this by saying that the Nernst lamp of which he has adopted something like 350 throughout Maidstone is the thing to compete with gas. Even when it was "their day out," and they were among friends, there were few of the electrical engineers who could give anything like unqualified support to Mr. Hoadley's statements. That gentleman has taken a big thing on himself in converting so many lamp columns in Maidstone to the Nernst system; and, of course, he must make good his position, if only on paper. If there is one thing above all others that the author does prove, it is that the Nernst light still suffers from many of its congenital defects, though every endeavour has been made to overcome them. But of all the various types, the ½-ampere "A" lamps are regarded as best for Maidstone, and the "D" type are looked upon hopefully. But both in the paper and the discussion, experience is common that the Nernst lamps depreciate fairly rapidly; that there is a good deal of trouble with the cut-out coils in the lamps burning out; and that wet weather exercises a deleterious effect on the "burners," which have to be replaced much oftener during a spell of wet weather than during an equal period of fine weather. There is a curious want of uniformity about the lamps in regard to their life and disadvantages. The author finds the average life is 676 hours, which means that, taking the lighting hours applying in many places to public lighting, these Nernst lamps would require renewing five to six times a year.

However, the question of comparative cost for the performance rendered is the main thing; but what dependence is one to place on lamps that are of such variable mood as Mr. Hoadley himself admits these to be? He tries to make out that in this lamp is the competitor on equal grounds of the incandescent gas-burner. Let us see how he proves his case. In one part of the paper he gives the illuminating power of the "A" lamps as 75 candles; in another part, he says the candle power, in some cases, does not appreciably drop for quite a long life, while others "lose a great deal" of their light-giving properties "in a very short time." That is not the kind of street lighting that ratepayers want to pay for; and yet he asserts that the unreliable lamp on which he has been writing these experiences will give "a degree of illumination superior to the incandescent gas-mantle." Mr. Hoadley contradicts himself very seriously, and requires a lot of understanding. In some of his other figures, we find the author stating the illuminating power in candle-power-feet. These figures—Mr. Haydn Harrison showed in the discussion—worked out to an average of 40-candle power, which is about what he has himself realized in his tests; while he has also got down to 20-candle power through dirty globes. Mr. Fedden, of Sheffield, too, has obtained some shocking differences between the actual and the reputed candle powers of these Nernst lamps. In the light of his own figures, those of several other speakers, and the confessions of variability, how is it that Mr. Hoadley cooly claims that, as compared with incandescent gas-lamps spaced 40 to 50 yards apart, an equally illuminated street can be obtained by ½-ampere Nernst lamps at a distance of 55 yards apart?

Again, Mr. Hoadley has apparently been collecting the costs of single incandescent gas-lamps from the worst of all possible quarters; for he finds that the cost varies from £3 to £4 "as a general rule." We cannot believe that he has found anything of the kind "as a general rule;" and we are confirmed in this by the succeeding statement that he "thinks" £3 10s. is an average figure. We are glad that he only "thinks," and will not advance it as a fact. But the strange thing is that, taking this high figure for ordinary single incandescent gas-lamps, he finds that the capricious and fragile Nernst lamp only works out to the same figure, when kept alight from dusk to dawn. He helps the Nernst lamp in the first place by taking a price for ordinary incandescent gas lighting which cannot be the figure in Maidstone where the gas is cheap, and then allows it electricity at an extraordinary low price. Out of the £3 10s. for the Nernst lamps, he reckons that renewals, lighting and extinguishing and cleaning, interest and sinking fund charges, repairs and maintenance of fuses, &c., absorb £1 9s.; so that there is £2 1s. left for the 390 units of electricity consumed per lamp, which works out to 1·3d. per unit. Unless the circumstances of Maidstone have changed considerably since the electricity accounts for the year ending March, 1904, were published, they cannot afford to supply their public lamps at this price. The total costs per unit sold then amounted to 1·70d.; the private consumers were being supplied at an average of 3·21d.; and the public lighting, at 1·80d. And there was a loss

of nearly £1300! We can only find 20 public authorities out of 170 who are charging themselves 1·3d. or less per unit for their public lighting; and these are towns whose conditions in respect of electricity supply are of a superior order to those of Maidstone. We have summed up here the amount of absurdity that Mr. Hoadley, with an alarming straining of figures, has pressed into his paper; and we are glad to see that taking the discussion as a whole, other electricians were not prepared to take Nernst lighting on the author's valuation. Mr. Wilkinson, of Harrogate, introduced into his remarks an axiom that few electricians will be propared to accept. It was: "The true economy of conversion [from gas to electricity] must be such that the annual saving effected by electric lighting must be such as to pay interest and sinking fund charges on the amount of capital outstanding on account of the displaced gas lighting." Such a condition is a long time coming.

The annual report of the Board of Trade respecting the applications to them for Provisional Orders under the Electric Lighting Acts has been issued; and it shows a falling off in comparison with last year. Altogether, there were 62 applications as compared with 74 in 1904. Of the 62, 33 emanated from local authorities and 29 from companies or private persons; so that they were nearly equal. Only one of the applications related to the County of London; but London has quite sufficient to look after in respect of the direct promotions of Electricity Bills in Parliament. Of the applications, 56 were granted by the Board, and were included in Bills submitted to Parliament for confirmation. Six of the applications were not granted. In the case of four of these, the consent of the local authority had not been obtained; and the promoters failed to satisfy the Board that it should be dispensed with. In another instance, the promoters had neglected to comply with the requirements of the Act of 1882, and the rules of the Board. The remaining non-success was due to the Board having to choose between the applications of a local authority and of a company; and their preference went to the former. Prior to this session and since 1883, 1171 Orders have been applied for, 925 have been made by the Board, 909 confirmed by Parliament, and 172 have been revoked. No applications for Licences have been entertained during the year by the Board. Within the year, eleven deeds of transfer have been approved by them; and these show a tendency to the handing over to power and large distribution companies of the powers, duties, and liabilities of undertakers. The consideration that power companies appear to be receiving from Parliament—as witness the second reading of the Administrative County of London Bill last Thursday—must have some effect on promotions in the future. If there is one good influence which we can pick from among a number of disadvantages in the handing over of large territories to bulk and power electricity supply companies, it is that it will take some of the keenness off the desire of municipal authorities for speculating in electricity supply; but it must also result in limiting the range of private enterprise in electricity in the future. There is a chance of some few rapid fortunes being made from these big electrical promotions; but the electrical industry and much invested money will be sacrificed in the process.

With great *éclat*, the Pigeon House Fort electricity works of the Dublin Corporation have been opened. Naturally, all who have had anything to do with them say they are the most magnificent of anything of the kind ever seen, and they are going to work wonders for the people of the city who have long suffered from the bad fortune that has pursued their electricity undertaking. Of course, a large amount of money has been spent on the works; and just before their opening everybody in the city, through the Corporation and through the newspapers, were made, by the repetition of the news, to understand that there has been a complete reversal in the fortunes of the concern, and that at last it is profitable. Poor deluded ratepayers. If it were not for those 500 voracious arc lamps that illuminate the city, and which are charged out to the ratepayers at about the top, if not the very top, price of arc lamps in Great Britain and Ireland, the concern would not look so well as it is now pictured after its many years of tribulation. However, while the ring of this financial "success" for which a dreary wait has been made is still in the ears of the ratepayers, and before the glory surrounding the Pigeon House Fort works has faded, the Committee have opportunely advanced another proposal for an application to the Local Government Board for the no mean sum of £100,000; and they tried to rush the matter through the Council, by getting the standing orders suspended, on the Saturday preceding the Monday on which Pigeon House Fort was to surrender itself to municipal inspection and inauguration. But the necessary majority of councillors could not see that there was any necessity for such violent hurry, and so the matter was delayed. Another item is that Mr. Robert Hammond has not been definitely cleared from his office of consulting engineer. As one councillor puts it, "he has been more than a match for the Dublin Corporation," and has succeeded in getting himself retained as consulting engineer for such work as the Committee chose to direct him to advise them upon, after the work he has in hand is finished.

Alderman William Blake, the Chairman of the Guildford Gas Company, whose death was announced in the "JOURNAL" at the time of its occurrence, left estate of the value of £17,248.

ECONOMY AND EFFICIENCY IN TRAIN LIGHTING.

LOOK at a railway map, and note the railway lines taking their sinuous courses throughout the country, intersecting and linking up with each other at numerous points, and appearing in the graphic representation almost like a net thrown over the land. Consider then the numerous trains that, after the light of the day has failed, are through the evening and during the night speeding to their almost innumerable destinations. Consider, again, that during these hours all the trains have to be illuminated—for safety, convenience, and comfort; and then ask the unanswerable question, What does all of this lighting cost? It is not always a futile exercise to initiate the consideration of a subject at a point that does not admit of a ready reply, and to sheer from it to others that have a bearing upon it. We have no hope of ever arriving at a reliably approximate answer to the question, for the reason that the lighting is still of varied condition—that antiquated smoky oil-lamps are still in existence, that electric lighting of relatively inconsistent character and performance has had considerable application, that Pintsch's Patent Lighting Company's system of compressed oil-gas lighting is largely in vogue, and, now that this system applied to incandescent mantles has been demonstrated to be an economic and efficient success, it is largely on trial, and is being looked upon with favour.

Arriving at the conclusion that the question cannot be answered with any degree of satisfactory accuracy as to what all this varied lighting of our railway trains cost in the aggregate, it is comparatively easy to arrive at some determination as to which is the most economical system of train lighting of those above mentioned. But in considering the economic question, we must conjoin with it that of efficiency—for it would be an easy matter by indifferent means to attain to a cheapness in lighting that would to a certainty bring any line into disrepute, and do it and the districts through which it passes incalculable harm. In suburban traffic, for instance, with the ever-increasing competition of the convenient and expeditious tramway services, unless the railway companies are prepared to offer counterbalancing comfort and conveniences, there will be a growing and very serious loss of business. Good lighting must therefore be taken as having for them a commercial value; and good lighting combined with economy and reliability is what the railway companies want. Neither can be obtained by the old system of oil lighting, involving as it does so much labour in trimming and cleaning, and yet resulting in the vexing of the souls and eyes of passengers by trains so illuminated. Electric lighting is expensive in its installation and running, the wear and tear is great, reliance upon it is far from being assured, and the illuminating result from the travellers' point of view is too variable to be voted a success. It is a strange thing that it is impossible (or at all events we have found it so) to get accredited figures as to the cost of train electric lighting. But on good authority, we are told that the cost of an electric lighting installation on a single train on the Great Western Railway is approximately £700; and the running expenses are of a character that the less said about them the better. The Directors of the Great Western Railway Company have also, we understand, stopped their orders for the electric lighting of trains, since they have found something of a more economical character, and giving greater efficiency, in incandescent gas-lights. An inspector on the Brighton Railway not long since told an inquirer of the breakdowns and troubles they had experienced with their electric lighting installations, which helped to run up the costs. On another line running out of London, a suburban train, with compartments fitted with two nominal 8-candle power lamps, had in each compartment only recently one lamp shedding dismal illumination. A distressed passenger cried to the guard for "more light;" and the unsympathetic but dutiful guard replied that "his orders were to switch on only one lamp, so as to save." Save what? These are peeps behind a tightly drawn veil. Then we have the Pintsch Company's system of compressed oil-gas lighting, a general description of which appeared in a previous article. The actual costs involved by this system are easily ascertainable and confirmable, seeing that 75,000 carriages and locomotives have been fitted with the system in the British Empire alone. With this system, using the old flat-flame burner, an illuminating power of 8 candles per cubic foot of gas per hour is obtained, or, if double-burnered lamps are employed, 16 candles. The cost of lighting, including depreciation of plant, interest on capital, and working expenses, varies between 0·2d. to 0·3d. per light per hour, according to the cost of fuel and labour. Compared with oil lighting and electricity, this is declared to be cheap. But, even so, it is not all the traveller by train at night time requires to enable him, in any seat he may occupy in a compartment, to read with perfect comfort. But we all know, from recent reported experiences, that, by the combination of this system with the incandescent gas-burner, the two extremes of great economy and the highest efficiency have been concentrated. Success of such a marked order has followed the first experiments with this combination, that trials which may be truthfully described as extensive are now being made on all the principal lines in England and the Colonies; and the reports that have been received are of an exceedingly gratifying character. Both the vertical and inverted forms of burner have been tried; but the latter, being shadowless, they have gained the higher approbation in general working.

Improvements in details connected with this system of lighting

railway trains have followed in rapid succession since our last article was published; and this is the justification for now giving some further consideration to the question from the standpoints of economy and efficiency, as we have the utmost faith in the power of this method of public demonstration to advantage the system of lighting to which the gas industry are so infinitely indebted. It is with this system that the Pintsch Company are now competing with electricity in the particular province of lighting which they have made so much their own, and with which they are offering economies to the managers of our railway systems which have not hitherto been approached in the superior lighting demanded by the times. The latest developments are to be found on a Pullman car running on the Brighton line; and by permission of Mr. W. Forbes, the General Manager of the London, Brighton, and South-Coast Railway, a party of gentlemen were privileged to travel from Brighton in this car, for the purpose of inspecting and judging of the lighting, last Thursday night. The train by which the party journeyed to Brighton was fitted with the electric light; and it was possible to take an optical measure of its efficiency in passing through the several tunnels *en route*. It was not, however, until the party found themselves enjoying and admiring the effulgence in the Pullman car at Brighton that they realized what a stride had been made by the new system. Just as an electrically-lighted carriage, with the lighting at its best, was a great advance over the old oil-lamp, so the visitors, whatever their prejudices, could not evade the admission that the lighting of the Pullman car was an immense advance over an ordinary electric lighted one, and represented the acme of carriage lighting within their experience, at a remarkably low expenditure. There were only four lamps in the carriage fitted with inverted burners (which the Pintsch Company are using under an agreement with the New Inverted Incandescent Gas-Lamp Company). Each was giving a light of 80 candles, measured photometrically at a distance of 6 feet from the mantle, with a consumption of only 1·3 cubic feet of compressed oil gas per hour. Therefore from the four burners a light of 320 candles was being obtained, with a consumption of only 5·2 cubic feet of gas per hour.

To illustrate what an improvement the Pintsch Company have effected by the incandescent mantle upon their former system of flat-flame lighting, it has only to be mentioned that these four lamps were each previously fitted with four flat-flame burners, consuming (each cluster) 3·5 cubic feet of gas, and giving a light of only 28 candles. Therefore, for the lighting of the car, by the flat-flame method, 14 cubic feet of gas were used, and an illuminating power of 112 candles obtained—showing that the inverted incandescent burners have effected a saving of 8·8 cubic feet of gas per hour, with an increase of 208 candles in the illuminating power. As to what this means in economy in the amount of gas required to be produced, in consumption, labour and time occupied in recharging the cylinders, multiplied by hours of use and number of running cars, railway authorities need no instruction from us. The mantles were as purely incandescent as it is possible for mantles to be. Incidentally it may be stated that the train of ordinary carriages that has been running experimentally on the line since January last is fitted with burners giving 25 candles with a consumption of only 0·6 cubic foot of gas per hour. The improved type of burner with which the Pullman car is fitted is so constructed that the mantle is supported by the reflector; and reflector, mantle, and globe are carried by a hinged frame, so that all parts are accessible for cleaning or attention within the carriage, without removing the mantle, and with the minimum of trouble. The improved burners can also be adjusted to take mantles of illuminating powers ranging from 25 to 80 candles.

Now as to the durability of the mantles, it will be remembered that those which the Pintsch Company are using are fitted with a patented wire framing. The New Inverted Company are the makers; but the Pintsch Company have the rights to their exclusive use. Experience has shown that, in general lighting, the inverted burner mantle, if not subjected to violent treatment, has a longer life as a rule than the ordinary mantle; and for railway lighting they are now made of tougher material, supplemented by the wire basket, the duty of which is to support fractured mantles, so that a carriage cannot possibly be thrown into darkness. For this purpose it has been found very effective. The experience on the Brighton line is that the mantles will stand the strain of vibration and shock well for an average of two months; and they are commonly in use for four months without being destroyed. It may with confidence be said that the saving of gas will far exceed the cost of the mantles, without taking into consideration the generous increase in the light, the intensity of which the experience on the Pullman car demonstrated does not fluctuate. These are the passengers' gains. And where the oil-gas system is already installed, these improvements can be achieved at the cost of a few shillings per lamp. By means, too, of bye-pass lights, the lighting of a whole train can be controlled from the rear by means of a single lever; and this is an advantage on railway routes with tunnels.

We have failed to answer the question in the opening paragraph as to what is the total cost of lighting our railway trains; but, working from that point, the consideration given to the subject leaves no doubt as to which of the various systems of lighting in vogue offers the highest illuminating efficiency in relation to initial expense and running costs. About railway train lighting, it can be written that notable progress has been made.

THE GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 131.)

LAST week opened on the Stock Exchange with a more cheerful air. Political apprehensions were smoothing out; money was in abundance; the weather was fine for traffic; and things in general were bright. But nothing much came of it all. Business remained very quiet, and one or two markets went distinctly bad. Then, it was a very "sporting" week; and the attractions of Henley, Lord's, and Wimbledon led many members away. However, if things were not very good, they were not very bad; and the tendency at the close was favourable. The Money Market was very easy; there being an abundant supply demanding employment at the best rates obtainable, and the discount rate was relaxed also. Business in the Gas Market was about a fair average. There were not many changes in quotation and these were irregular—movements appearing to respond to the special circumstances affecting the specific issue. So far as it is possible to generalize, the market might be pronounced fairly firm. In Gaslight and Coke issues, the ordinary was less active than it has ruled of late, and was fractionally easier in consequence. The best price was 99, at which a large proportion of the marked transactions were effected; and the lowest was 98¼. Of the secured issues, the preference was the most in evidence. Dealings were marked at from 109½ to 110½. Nothing at all was done in the maximum; but the debenture was done at 89 and 89¾. South Metropolitan was pretty active at first, but cooled away to nothing later on. Transactions ranged from 128½ to 129½—the same figures as those of the previous week. Nothing was done in the debenture. Commercials were quiet but strong. Both capital issues had an improvement of one point. A couple of transactions in the 3½ per cent. were at 112¼ and 113¾. The Suburban and Provincial group exhibited their usual quietude and solid strength. There were transactions in Brentford new, all at 190½. Hastings and St. Leonards changed hands at 102. South Suburban ordinary was done at 121½ and up to 123½. West Ham ordinary marked 103, and ditto debenture 107. Business in the Continental Companies was light. Imperial was dealt in a few times only at prices ranging from 210¾ to 211½. European was not touched. Union was done at 108, and then, being quoted *ex* the right to an allotment of a small parcel of stock which the Company are offering at 102, prices fell away to between 105 and 106. Among the undertakings in the remote world, Bombay marked 6⅝ and 6 13/16; Oriental, 145½. Hong Kong changed hands at 18 and 18⅛. Cape Town ordinary marked 17⅜, and ditto preference had a rise without business done. Buenos Ayres had a transaction at 11 13/16, and ditto debenture at 97. River Plate was rather active, with dealings at from 11 15/16 to 12⅛. Primitiva ordinary marked 5 15/16, ditto preference 5¼, and ditto debenture 96½. Monte Video was done at 11⅝ and 11¼, and Melbourne 5 per cent. at 102½, with an advance of a point in the quotation.

The closing prices are shown in our Stock and Share List on page 131.

Appointment of an Engineer as a Director of the Continental Union Gas Company, Limited.

Mr. Arthur F. Phillips, the Chairman of the Hong Kong and China Gas Company, and a Director of other English and Continental Gas Companies (with professional experience also in the management of gas-works in Italy), has accepted a seat on the Board of the Continental Union Gas Company.

The New River Company and their Employees' Bonus.

Early in the year we called attention to the laxity of the Directors of the Lambeth Water Company in recognizing the services of their employees by granting them some compensation on the transfer of the undertaking to the Metropolitan Water Board. In the course of our remarks it was pointed out that this question had been dealt with by six out of the eight Metropolitan Water Companies, leaving only two in arrear—one being the Lambeth and the other the New River Company. With regard to the latter, it was quite believed that the matter had not been overlooked by the authorities; but it was thought that the result had not been made known owing to the characteristic reticence of the officials of the ancient undertaking at Clerkenwell. We were therefore somewhat surprised to learn, from a paragraph in the "Pall Mall Gazette," that not only have the employees not received their bonus, but that they have not yet had any intimation as to what it is likely to amount to. This is an exhibition of dilatoriness for which there cannot possibly be any excuse; and consequently we are not surprised to find that the course adopted to move the Directors of the Lambeth Company has been followed in the case under notice. A memorial has been forwarded to the Directors; and we trust the result may be as satisfactory as it was with the Company south of the Thames. The employees of all the other Companies have already received the sums they were entitled to; and we understand that the average is three months' pay per head.

BELGIAN ASSOCIATION OF GAS ENGINEERS.

Annual Meeting at Liege—July 3 to 5.

LIKE their *confrères* of the Société Technique de l'Industrie du Gaz en France, the Belgian gas engineers were very fortunate with regard to the atmospheric conditions which prevailed during the progress of their meeting held in Liége last week; for, with the exception of a heavy thunderstorm which visited the town late in the evening of Tuesday, they were treated to glorious sunshine and blue skies. Possibly, however, it may have appeared to many that a somewhat lower temperature would have ensured greater comfort in dealing with the very varied programme prepared for their enjoyment. That the programme assumed an almost entirely social character may appear a little strange; but the explanation is not far to seek, for it must be remembered that only a month previously the Association had held a meeting in Brussels at which matters dealing with the purely formal and technical side of the profession had been discussed. Even had this not been the case, it is doubtful whether it would have been wise to have allowed formal business to interfere with the opportunities afforded to the members and their friends to visit the International Exhibition now being held in the town, and to inspect the interesting and instructive exhibits collected in the vast enclosure. To Belgians the success of this exhibition must be especially gratifying; for truly it has given to the world a proof of the great progress made by the nation in engineering. Prosperous and neutral, avoiding as far as possible interference with international difficulties, this wise country has devoted its time and money to improving its trade and industries, in which it has succeeded to an extent that must prove a most instructive lesson to the neighbouring nations. Truly, the Liége Exhibition fulfils the expressed desire of those responsible for its inception and carrying out, to the effect that it should "provide an opportunity to all people to meet on a hospitable and neutral soil in a peaceful conflict having for its aim the grouping together of the results of the progress realized in all branches of human activity." It would be difficult to imagine a more delightful situation for an industrial exhibition than the one chosen, nor a district more calculated to meet all the necessary requirements. Situated as it is on the charming Meuse, at the point of its junction with the Ourthe, Nature has provided Liége with all that could be desired from a picturesque point of view; while the presence in the district of so many important industrial concerns—chief among which may be mentioned the Société Cockerill, the factory of La Vieille Montagne where the zinc industry has developed to so marvellous an extent, the National Gun and Arms Factory, and the Compagnie Générale des Conduits d'Eau—ensured from the beginning full success from the truly technical standpoint.

SOME NOTES ON THE EXHIBITION.

It is not, of course, within the scope of this article to deal with the exhibition in a manner approaching in the least to detail. It can only be stated very generally that, from an engineering standpoint, the machinery exhibited is of a very high degree of excellence. It is, however, disappointing to find that England has taken so small a share in giving prominence to her manufactures. With such few exceptions as Messrs.Ar mstrong and Whitworth, Robinson, of Rochdale, Herbert, of Coventry (tool makers, &c.), Avery, of Birmingham, the Green Economizer Company, and a few others, one looks in vain for the names of English exhibitors. In fact, it may be stated in general terms that the exhibition is an engineering triumph for Belgium and France. What, however, is more disappointing to the gas engineer, whether English or Continental, is the very poor show made in the direction of giving prominence to methods and appliances dealing with the manufacture and use of gas or its residuals. It may, however, afford some little consolation to note that—perhaps except dynamos, many fine examples of which are shown—very much the same may be said with regard to the electrical industry. Gas-engines are by no means absent. The Société Fetu Defize and others show some most effective engines of a small type; while the Société Cockerill have a marvellous exhibit of engines of a very powerful class—one capable of indicating 1200-horse power being shown at work.* It is a compound engine of the tandem type, with four cylinders in all, and runs with remarkable smoothness. The same firm also show a compound engine of 500-horse power (two cylinder compound); and also a 150-horse power vertical engine. All these engines are working with town gas; but they are really intended to use low-power gas. Messrs. Richardson and Westgarth are the English agents for the Company. It is interesting and instructive to note that the Company, at their immense works at Seraing, are large users of engines driven by low-power gas; and that they are of opinion that in a few years their important factory will be wholly provided with motive power upon these lines, and that steam-boilers will consequently be entirely abolished. That producer gas and gas-engines, and not improbably gas-turbines, have a most important part to play in the future of motive power, must be fully acknowledged; and it behoves gas engineers to keep this fact prominently before them, and to take such steps as will ensure to them their due share in the developments which must shortly arrive. The exhibit of the Société Cockerill also includes a steam-engine of 10,000-horse power for rolling-mill purposes; while a prominent feature in their gun and arms department is a steel shaft about 170 feet long, and weighing upwards of 40 tons; also a steel shield similar to those used by the Japs to protect their soldiers while engaged in clearing the ground of barbed wire, &c. This shield is bullet-proof, and weighs about 50 lbs. The Solvay Company have some interesting exhibits of their soda process, and of their coke-oven plants, of which latter more than fifty are now installed in various countries—including, of course, Japan; while the former process is responsible for about two-thirds of all the soda produced in the world. These exhibits were kindly explained by Mr. Kirkpatrick, the Company's Engineer in Brussels. Messrs. Pratt and Whitney, of New York, through their Belgian agents, exhibit the Robins belt conveyor, in which a concave surface to the belt is secured by three small rollers placed beneath at the required angles to each other. Mr. N. Martin, of Huy and Brussels, has a good show of gas heating and cooking appliances; while a novel wet meter with a duplex drum, made by the Compagnie pour la Fabrication des Compteurs, of Paris, is exhibited by another firm. This is claimed to have many advantages, both for ordinary and for station meters; the principal ones being its far higher capacity and its great steadiness, even when much overworked. Some excellent examples of wrought-iron and steel tubing were to be seen; and in this connection it may not be out of place to draw the attention of English manufacturers to the fact that Belgian engineers do not appear to be entirely pleased with the quality of the material or workmanship in the pipe they obtain from this country, and that the opinion was expressed that it was better to use the tubing obtained from Germany—even if the price paid was found to be a little higher. (*Verb. sap.*) To deal further with the exhibition, or even to mention its attractions outside the Engineering Section, would be impossible within the limits of this article; and therefore with these few comments the matter must be left.

* Some reference was made to this engine in the "JOURNAL" for the 20th ult. (p. 884).

OPENING OF THE MEETING.

Returning to the subject of the article—the meeting of the Belgian Association—it must first be mentioned that on Monday the members and their many visitors met informally at the Lesansky Restaurant to sign the attendance-book and receive their tickets for the various functions and excursions. This being done, they dispersed to meet again at the same place at four o'clock in the afternoon, when they were formally received by the President, M. Brandt, of Brussels. Later in the evening, the Association gave a banquet at the above-named restaurant, which was brilliantly lighted by incandescent gas-lamps. The presence of many ladies added brightness and gaiety to a very pleasant gathering. After dinner, the President rose and cordially welcomed the many guests of the Association, and especially mentioned M. Visinet, the President of the Société Technique du Gaz, Mr. J.W. Helps, the Hon. Secretary of the Institution of Gas Engineers, Herr Körting, the President of the German Association, Heer Bauduin, of Maastricht, the President of the Dutch Association, and Signor Boella, of Turin. The President also thanked M. Rigou and M. Boscheron, Director and Engineer respectively of the Liége Gas Company, and referred to the services of Heer Van Heede, the Hon. Secretary of the Belgian Association. Most of the above gentlemen replied; and in the course of the speeches many pleasing references were made to the International Gas Exhibition at Earl's Court and to the visit paid to it by Continental Engineers. Indeed, throughout the whole of the proceedings, everything possible was done to indicate the excellent good feeling now happily existing between this country and her friends on the other side of the Channel. Despite the heat of the evening, an impromptu dance was started, which gave not only the younger but some of the older guests an opportunity of showing their ability in the saltatory exercises of the many nations represented.

AN EXCURSION TO SPA.

The following day was devoted to an excursion by train to Spa—a journey occupying about three-quarters of an hour. On reaching this fashionable Belgian watering-place, carriages were waiting to take the visitors on a tour round the fountains for which the town is justly noted. The drive proved most delightful; the country scenery being of a charming character. *Déjeuner* was served in excellent style at the Hotel Britannique; and at its conclusion M. Visinet, in a very happy speech, proposed the health of M. Brandt, and drank prosperity to the Belgian Association. On the return to Liége the evening was free, and was mostly spent in a further visit to the exhibition.

VISITS TO WORKS.

On Wednesday morning, soon after nine o'clock, a visit was paid to the works of the Compagnie Générale des Conduits d'Eau,

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situated about a mile outside the town. Here the members and their friends were courteously received by M. Doat, Director, M. Hérault, the Chief Engineer, M. Barré, the Secretary, and M. Camille Ancion, the Engineer, by whom they were conducted over the extensive foundries and workshops, which are principally devoted to the manufacture of gas and water pipes and special castings, including valves, retort mouthpieees, &c. There are two foundries, and a third and much larger one is in an advanced state of construction. In one of these six cupolas are erected, four of which were in use melting the 100 tons of iron per day which are used in the manufacture of pipe; and in the other there were three smaller ones employed in the production of special castings. All the pipes from 2 to 48 inches diameter are cast vertically; and the castings appeared to be of excellent character. Two special forms of joint for cast-iron pipes were shown—one the Trifet, the other the Somzée. Both have an india-rubber ring as the jointing medium; the only real difference being that the spigot of the latter is taper, while that of the former is parallel. These joints are said to be finding favour with Continental engineers. Considerable interest was shown in the action of a powerful machine used for breaking up the pigs of iron into suitable length, which did its work like a huge nut-cracker in a most businesslike way. During the inspection, the visitors were conducted to a spacious and well-appointed dining-room and canteen, where M. Doat graciously bade them welcome, and gave them an opportunity, on the proposal of the President, of drinking to the success of the firm in excellent champagne.

The Liége Gas-Works.

After luncheon, which was partaken of in the exhibition, a large party proceeded on the electric cars to the Bayard Station of the Liége Gas Company, where they were met by some of the Directors, as well as by M. Rigou and M. Boscheron and their assistants, by whom they were conducted over the works. The principal object of interest was a fine gasholder and steel tank under course of construction by the firm of Herr F. A. Neuman, of Eschweiler. The lightness of the framework was generally admired, though some of the visitors appeared to doubt somewhat whether it was not a trifle too light. Doubtless, however, there need be no fear on this score, as evidently the design has been most carefully considered. The tank is of steel, and is 165 feet in diameter. The holder has three lifts, and a capacity of about 1¾ million cubic feet. The total cost was stated to be at the rate of 7·6 frs. per cubic metre, or a little more than £8 10s. per 1000 cubic feet —surely a very low figure, and one which English engineers will find it difficult to improve upon. Pneumatic machinery was being largely used in the construction of the holder; the riveting, drilling, rhymering, &c., all being done by tools worked by compressed air. The whole of the four rows of girders between the columns were provided with railed gangways to ensure easy access to the framing for the purpose of inspection, &c.; and running entirely round on the inside of one of these girders was fixed a rail, on which ran a small trolley from which was suspended the blocks and chain for lifting purposes—a simple process which seemed to be productive of good results. Indeed, the Contractors throughout appeared to have fully recognized the importance of making use of all possible labour-saving devices. The only other portion of the works that was visited was the carburetted water-gas plant, erected by Messrs. Humphreys and Glasgow. The plant is in two sets, each capable of producing about 550,000 cubic feet per day. The officers of the Company expressed great satisfaction with it, and recognised the many advantages of the process. The Company possess two works, and intend to build a further section of a capacity equal to that at Bayard. The total annual production of gas is about 750 million cubic feet; the average illuminating power being about 13½ candles. The town is well lighted by incandescent gas-burners; the mantles being much larger than those generally used in England. It is satisfactory to note that only some 70 electric arc lamps are installed in the town, as against some 3000 gas-lamps. The Jardins d'Acclimatation, which are embraced in the exhibition grounds, are entirely lighted by incandescent gas-lamps, including a small installation of the "Millennium" system. The general effect is excellent.

Banquet by the Gas Company.

In the evening, the members and visitors were the guests of the Directors of the Liége Gas Company, who provided an excellent banquet in the *foyer* of the theatre. Mr. Rigou was in the chair; and to his charming personality was due to no small extent the great success of the evening's entertainment. In greeting his guests, he alluded in graceful terms to the presence of M. de Brouwer and to the great work that he had done for the gas industry. He also expressed the pleasure it gave his Company to welcome the Belgian Association of Gas Engineers and their visitors from the many countries represented; and he did not forget to pay a graceful compliment to the many ladies who by their presence added to the pleasure of the evening. After M. de Brouwer had returned thanks for the compliment paid him, M. Visinet replied in the charming and characteristic manner now so familiar to those who have the pleasure of his acquaintance; and he was followed by Mr. J. W. Helps, M. Bauduin, the President of the Dutch Association, Herr Salzenberg for the German Association (in the absence of Herr Körting, who, it may be remarked, had during the previous week been elected President of that body for the third time in succession—an honour which is believed to be unprecedented in its annals), Signor Boella, of Turin, and others. The speeches concluded with the submission, by M. Coze, of the toast of "The Ladies," for whom Mr. H. Salomons, of Brussels, suitably replied. At the conclusion of the banquet, the room was cleared, and dancing was indulged in till close upon midnight, when regretful farewells were said, and many hopes expressed for the renewal at no distant date of the friendships and acquaintances made during the meeting.

A Recognition of Hospitality.

It is difficult to sufficiently express the hearty appreciation of the kindness and cordiality shown by the Belgian Association to those who were fortunate enough to accept the invitations extended to them. The President (M. Brandt) and the Hon. Secretary (M. Van Heede) were indefatigable in their desire to do everything possible for their visitors' comfort; and in this endeavour they were largely assisted by their charming and amiable wives. M. Boscheron left nothing undone in the direction of seconding the efforts of the above-named gentlemen, while the friendly feeling which existed, and which constantly showed itself, throughout the proceedings was of so delightful a character as to have doubtless left a lasting impression on the minds of all who were present. It is to be regretted that only three members of the Institution of Gas Engineers were able to make the journey —viz., Mr. J. W. Helps, the Hon. Secretary, Mr. A. W. Onslow, of Woolwich Arsenal, and Mr. A. R. Cawley, of Caerphilly, the two latter gentlemen being accompanied by their wives. The French Society was well represented by the President (M. Visinet), the Secretary (M. Payet), M. Gastin Gautier, of Havre, M. Cornuault, M. Jules Freyss, and others. Germany sent several representatives, including Herr Körting, Mr. W. W. Drory, of Frankfort, and Mr. Salzenberg; while Heer Bauduin, Heer Bolsius, and others attended from Holland, and Signor Boella from Italy. It must also be mentioned that Mr. R. W. Wilson, the Secretary of the Imperial Continental Gas Association, was able to attend the meeting during the first two days.

GERMAN ASSOCIATION OF GAS AND WATER ENGINEERS.

The Annual Meeting at Coblenz—June 28 to July 2.

(*Continued from* p. 38).

This year exceptionally brilliant weather prevailed throughout the meeting of the Association; and accordingly the numerous excursions, which always form so attractive a part of the programme of these gatherings, were unusually well patronized. The heat-wave which was passing over the Rhine provinces at the time rendered work by day and sleep at night well-nigh out of the question; and on the Friday and Saturday the interest of members in the technical proceedings, which had been very keen on the opening day (Thursday) perceptibly flagged. The programme of amusements arranged primarily for the delectation of the lady guests was consequently followed by many members in preference to attendance at the sittings in the Banqueting Hall, though the ample proportions and good ventilation of the latter rendered it as comfortable as could be hoped for under the oppressive climatic conditions.

The final list of participants in the meeting reached a total of 612, exclusive of ladies, who must have raised the numbers to a grand total of 750. In comparing these figures with those for the past four or five years, it must be borne in mind that at Coblenz the local contingent was very small indeed; whereas at places like Vienna and Zürich it must have accounted for some 200 or more. This year's gathering could fairly be regarded as something more than a mere assembly of gas and water men from Germany, for almost all European countries were represented. Among those present were Russians, Danes, Swedes, Dutch, Belgians, French, Swiss, Italians, Austrians, Hungarians, Roumanians, and English. Only three of those present were reported as coming from London —viz., Mr. S. Simmelkjoer, the Engineer of the Cagliari Gas and Water Company, Mr. W. J. A. Butterfield, of Westminster, and Mr. R. W. Wilson, the Secretary of the Imperial Continental Gas Association. But among the numerous Engineers at Continental works of the latter Association who were present, were several who would fitly be spoken of as English. The Association was well represented—no doubt, in some measure from a sense of obligation on the part of its Engineers to the German Society for the re-election as President for the third year of their veteran colleague, Herr Körting.

Photometric Committee's Report.

Reverting to the technical proceedings at the meeting, the report of the Association's Committee on Photometry, which was

presented at the close of the sitting on the 29th ult., deserves fuller notice than could be given last week. The Committee have reconsidered the prescriptions made in 1898 with reference to testing the illuminating power of gas, and have made further investigations not only on this question, but also on the testing of mantles. The report on these matters is ready for publication as soon as the comparisons which are being made at the Physical-Technical Institute at Charlottenburg of the carcel, Harcourt pentane, and Hefner lamps have been completed. It is intended to include the results of these comparisons in the report. The Committee have also, by way of supplementing the researches made at Munich last year on the illuminating effect of gas and electric arc lights*, taken up the question of the measurement of surface brightness and the distribution of light. One fact became plain—viz., that the standard for the degree of illumination which was essential, which had been laid down by ophthalmic experts on hygienic grounds, rested on very uncertain foundations, and had been very differently interpreted and applied. Thus a wholly erroneous conclusion might be arrived at in any case with reference to the effect of a lighting installation. The Committee therefore thought it imperative, in the interests of the gas industry, to investigate the matter with a view to throwing light upon the question, and establishing unexceptional and rational standards. The experiments undertaken last year by Dr. Leybold, at the instance of the Committee, on the effect of mixing carburetted water gas in different proportion with coal gas, are at the present time being extended, under Herr Zink, to simple (" blue ") water gas and to water gas carburetted with benzol. His work so far has been beset with difficulties in regard to the gas pressure, the mantles used, and the burners, which necessitate further investigation; but the Committee hope shortly to publish the results of his experiments. They have also had under consideration, in view of the increasing distribution of gas to long distances, the question of whether its quality is affected thereby. Herr Hase has placed the Lubeck-Travemunde trunk main at the Committee's disposal for investigating this question as well as the fall of pressure which occurs in long mains.

It will be seen from this summary of its report that the photometric Committee have many interesting problems under investigation and their next report should prove to be a very valuable document.

Water Supply.

The technical programme was resumed at nine o'clock on the 30th ult.; but the items down for consideration this day dealt chiefly with water supply. First Herr Rath, of Ahrweiler, read a paper on the " Rural Means of Water Supply in the Rhine Provinces, and the District of Coblenz in Particular." This paper was, of course, primarily of local interest, and need not be referred to further here. Then the report of the Association's Committee on " Water Statistics " was taken, in conjunction with a communication by Herr F. Reese, of Dortmund, the Chairman of the Committee, on the " Effect of the Drought of the Year 1904 on Water Supply." It will be remembered that this Committee undertake the compilation of annual volumes of statistics relating to water supply in Germany, of which the sixteenth issue is about to be made. This volume will contain particulars of supply collected from 338 water-works. Some changes have been made tending to reduce the size of the volume without detracting from its comprehensiveness. The work is invaluable to water engineers whose sphere of activity is not restricted to a particular locality, but spreads over districts as varied as those comprised within the German Empire.

Herr L. Wellmann, of Charlottenburg, next presented the report of the Committee on " Managing Water-Works." In so far as the Kingdom of Prussia is concerned, the Committee have succeeded in arranging with delegates of the Government a code of fundamental rules for the installation and conduct of water-works taking their supply from wells. These regulations have been published; and, under the head of " Installation," they comprize nine points—viz., the water requirements, its quality, the nature of the water-bearing strata, its safety from surface-contamination, general hygienic requirements for the works, special requirements for the storage and distributing plant, requirements in plant for improving the quality of the water, special requirements in water storage, and the same in water distribution. Under the head of " Working," a few concise instructions are given with the object of precluding any failure or disturbance of the supply. The Committee will continue their work till similar regulations have been adopted in other parts of Germany.

Inverted Gas-Burners.

Then Professor Drehschmidt, the Chemist to the municipal gas undertaking at Berlin, gave a lecture on the " Inverted Incandescent Gas-Light." He exhibited a number of early examples of inverted gas-burners, including one in which an ordinary upright Welsbach burner had been converted into a practicable inverted burner by little more adaptation than the mere act of inversion. He stated that nearly all types of inverted burners which he had tried were unsatisfactory, because blackening of the upper parts of the burner ensued. He gave the results of a number of comparisons he had made of the illuminating power in varying directions of four types of inverted burner and an ordinary incandescent burner, with and without reflector. The different inverted burners were distinguished by initials only. In the appended table are given the principal results reported by Professor Drehschmidt, but stated in English candles instead of in Hefner units.

* See " Journal," Vol. LXXXVII., p. 395.

Illuminating Power, in English Candles, of Inverted and Other Incandescent Gas-Burners.

—	Ordinary Upright Incandescent Burner.		Inverted Burners.			
	No Reflector.	With Reflector.	G.	P.	W.	M.
Horizontal illuminating power	78·9	79·2	48·3	38·9	94·3	78·9
Consumption per hour, cubic feet	4·42	4·42	3·32	2·47	4·20	3·92
Mean illuminating power—						
Spherical	59·8	..	36·4	32·8	75·6	68·9
Lower hemispherical	54·6	58·0	43·9	43·0	96·0	90·4
Upper ,,	65·1	..	28·8	22·6	55·3	47·5
Candles per cub. ft. consumed—						
For mean spherical illuminating power	13·54	..	10·97	13·28	18·01	17·60
For mean lower hemispherical illuminating power	12·36	13·13	13·22	17·42	22·88	23·08
For mean upper hemispherical illuminating power	14·74	..	8·67	9·15	13·17	12·12
Mean illuminating power stated as a percentage of the horizontal illuminating power—						
Spherical	75·8	..	75·3	84·2	80·3	87·3
Lower hemispherical	69·1	73·2	91·0	110·4	101·9	114·4
Upper ,,	82·5	..	59·5	58·0	58·7	60·2

It is evident from this table how great an advantage the inverted type of burner has over the ordinary upright burner in respect of lower hemispherical illumination, which for most practical uses is the all-important item. In regard to the various burners, it was understood that Professor Drehschmidt had obtained the best results with the inverted burner known in Germany as the " Maaske," and that it was the only burner of this type in which he had found the smoking trouble non-existent.

For comparison with Professor Drehschmidt's figures, it may be useful to state values which were put before the meeting as to the results obtained by Professor Wedding, of the Technical College at Berlin, with various patterns of the Kramer inverted burner, which closely resemble the inverted burners in common use in this country.

Results of Tests of the Kramer Inverted Burner.

Type.	Consumption. Cubic Feet per Hour.	Lower Hemispherical Illuminating Power.	
		Maximum. English Candles.	Mean (Approximate). English Candles.
A	2·10	42·2	38½
B	2·90	59·6	51½
C	4·22	68·2	65
D	3·20	96·5	80
K	1·09	14·9	13

Professor Wedding has found, by continuous trials extending over a year, that these inverted lamps behave satisfactorily, and do not give any trouble even under the care of different servants.

The St. Gall Gas-Works.

After Professor Drehschmidt's lecture, Herr Zollikofer, the Manager of the St. Gall Gas-Works, gave a description of these works, with special reference to the distribution of gas to distant townships which takes place from there. Some particulars of this recent Swiss enterprise have been given from time to time in the " Journal;" and it is hoped to give shortly a fuller account of the work than would fitly fall within the scope of this report. For the present, therefore, it will suffice to say that the works are equipped in the most modern and approved fashion. There are six settings, each of nine inclined retorts, 19·7 feet long. Electro-motive power is used to drive the coal elevator, &c., and a suspension coal-conveying line is used to carry the coal to the breaking-machine. The coke is discharged on to a De Brouwer trough, and conveyed to an elevated storage, breaking, and sorting plant, whence it can be shot direct into trucks. The works are lighted by " Millennium " high-pressure gas-lamps. The distributing system runs from the town of St. Gall mainly in two directions, extending one way about 10 miles, to Rorschach and Steinach. Owing to a great portion of the area of supply being at a considerably higher elevation than that of the works, the volume of gas registered by the consumers' meters is appreciably more than that recorded by the station meters, so that in place of a loss under the head of unaccounted-for gas, Herr Zollikofer is in the happy position of having a gain. The regenerative furnaces in use have worked so satisfactorily that the coke consumed in them, after deducting all the unburnt coke recovered, amounts to only 12 per cent. of the weight of coal carbonized. The long inclined retorts, which are somewhat of a novelty in Continental works, have proved very successful.

Other Items of Interest.

This paper concluded the technical proceedings for the day, and the afternoon was devoted to a steamer trip up the Rhine. Two of the large steamers of the Rhine Steamboat Company conveyed the party as far as the Lorelei rock, opposite which Heine's beautiful verses, founded on the legend of the Lorelei, were sung with great fervour. A halt was made at St. Goar for refreshments, and the return journey began as dusk supervened. The Stettin Fire-Brick Company's (the Didier-Stettin) works at Niederlahnstein fired salutes to the party on its outward trip, and gave a display of fireworks as the boats passed the works on the return journey. The castle of Ehrenbreitstein (opposite Coblenz) was beautifully illuminated by coloured fire as the party reached it, and numbers of rockets were fired from it.

The Stettin Fire-Brick Works were visited by many of those who attended the meeting on one or other of the days. The works are of very large size, and manufacture all descriptions of fire-resisting goods for use in gas-works. The at one time well-known Didier regenerative setting emanated from them.

The technical programme for Saturday, the 1st inst., comprised items chiefly of interest to water engineers. Professor Kolkwitz, of Berlin, dealt with the "Biological Aspect of Impounded Valley Waters," and Herr E. Grahn, of Hanover, with the "Significance of the Year 1901 for Water-Works." Herr Neumann also described some new water-works. Mr. W. H. Lindley, of Frankfort-on-the-Main, presented the report of the Association's Committee on Electrolysis or Vagrant Electric Currents, of which he is the Chairman. The report is a long one, and fully describes the scheme of researches in progress at Strasburg and Dresden. As the matter is of great importance to nearly all gas and water undertakings, it is proposed to give in an early issue an exhaustive abstract of the report.

The private business of the Association was next dealt with, and in regard thereto it is only necessary to remark that its finances continue in a very satisfactory state. In the year 1904-5, the Association received special contributions to be applied to scientific purposes, amounting in all to about £637. These contributions prove of great assistance in enabling the valuable work of the Technical Committees appointed by the Association to be carried on. It was decided to hold next year's meeting at Bremen.

Saturday's proceedings closed with a banquet in the Banqueting Hall, to which upwards of 600 persons sat down. Herr Körting, in proposing the toast of "The Kaiser," recalled in a humorous speech first the Schiller banquet of 1859, which inaugurated the German Association of Gas and Water Engineers, and then some notable subsequent gatherings. The toast of "The Association" was given by Herr Ortmann, the Burgomaster of Coblenz. Among the many speeches made during the evening, the palm for humour was accorded, by universal consent, to Mr. W. H. Lindley, who, as readers of the "Journal" are aware, is the President of the Junior Institution of Engineers. After midnight, eating gave place to dancing; and daylight was dawning ere most of the guests left the hall.

On Sunday, an excursion was made by special train to Ems, where an enjoyable afternoon and evening were spent. With this, the forty-fifth annual meeting of the Association was brought to an end.

TESTS OF "RADIANT" FUEL.

It is approaching a twelvemonth since that we, with many others, were surprised by some most extraordinary claims that were advanced in a daily paper for a new fuel for gas-fires which was to be introduced under the name of "Radiant." Imagination had been—as it frequently is in the serving up of news by the latter-day journalist of the cheap morning and evening sheets—strained until there was more nonsense than anything else written about the promised new fuel. The very extravagance of the claims provoked not only scepticism but immediate derision. Inquiries were made into the matter, with the result that our readers were put in possession of all the information that could at the time be gathered in reference to the new material. At the same time, we promised those who had discovered the many virtues that the new composition possessed above other gas-fire fuel that, if they submitted to us a sample of "Radiant," it should be subjected to a fair test in comparison with a fire supplied with previously unused fuel of ordinary character. Of course, we were interested in proving the value of the claims, as, if there was any superiority in the new fuel, then it would be to the advantage of the gas industry to learn of it. The inventors accepted our offer; but from various circumstances—principally due to the preparations for making the fuel—the samples were only delivered at this office about the beginning of May last.

There were two qualities of "Radiant" submitted, which for identification we have respectively designated "dear" and "cheap." The "Radiant" fuel was forwarded by us for the purpose of the test to a competent and reliable experimentalist, with a request that the two samples should be submitted to what would be considered a fair test in comparison with new ordinary fuel, and in the same gas-fire. The durability of the material was a point to which attention was also to be directed; and the report opens with the remark that "the dear fuel when received was found to have half the balls broken, while the cheaper had only about one ball broken." This was a decidedly bad start. However, in the tests, the report informs us, a Fletcher stove was used, and the same one for the three types of fuel, and the same number of balls was employed in each test. The room was rather a large one in which the tests were made, being 24 ft. 6 in. long by 21 ft. 6 in. wide by 12 ft. 6 in. high, and contained four windows 7 ft. by 4 ft. Of course, there was no intention of attempting to heat such a large room by the fire under trial; the principal intention being to test the "radiant" heat of the fuel itself. For this purpose, a black-bulb thermometer was placed at a distance of 3 feet from the bars of the stove; the bulb being on the same level as the top of the burner. Each fuel was tested for an hour on three different days; the thermometric readings being registered every five minutes, and the gas consumption every fifteen minutes. The figures are given in the following table:—

Time. Minutes.	Radiant Heat of Fuel.			Gas Used each 15 Minutes.		
	Dear.	Cheap.	Ordinary.	Dear.	Cheap.	Ordinary.
	May. 18.	May. 22.	May. 19.	Pressure 9-10ths.	Pressure 8-10ths.	Pressure 9-10ths.
Start.	63°	52½°	61°	Cub. Ft.	Cub. Ft.	Cub. Ft.
5	69½	56	67			
10	80	64	76			
15	88½	70	84	4·5	4·1	4·5
20	94½	75½	89¾			
25	99½	79½	94¾			
30	103	82¾	98½	4·6	4·2	4·5
35	105½	85	101			
40	107½	86¾	103			
45	109	88½	105	4·4	3·8	4·4
50	110	89½	106½			
55	110¾	90½	107½			
60	111½	91½	109	4·4	4·1	4·5
	Total Rise of Temperature.			Total Consumption.		
	1 hour .. 48½°	.. 39°	.. 48°.	17·9	.. 16·2	.. 17·9

These results indicate that, from the heating point of view, the "Radiant" fuel has no more value than the ordinary. Using the same consumption of gas as was found to be best for the dear fuel in the stove employed, the rise of temperature in an hour with the ordinary fuel corresponded with that of the dear fuel, and was considerably better than the cheaper fuel. Unless, therefore, in some other respect, "Radiant" can show superiority or exclusive merit, it can only enter into competition on terms of commercial equality with other fuels. The report, however, does not assist us to the belief that "Radiant" has any merit greater than ordinary ball fuel; but, on the contrary, it appears to be afflicted by a frailty—or rather the more expensive quality—that will be very detrimental to it. It has already been shown that in the transmission of the fuel for testing, half of the number of balls of the dear class were broken; while the cheaper fuel had only one broken. The report proceeds:

> When the stove was on, the dear fuel imparted a considerable amount of green colour to the flame; the cheaper not so much. The dear fuel is very friable, both before and after heating, and will not stand any knocking about. The cheap fuel has the same degree of hardness as the ordinary. As regards the comparative red glow of the three kinds of fuel tested, there is not much to choose between them. If anything, the thinner branches of the ordinary fuel used, as compared with the "Radiant" samples, allow the flames to play more freely about the solid material of the balls, so resulting in a more general glow.

It will therefore be seen that, in addition to being easily fractured, the dear fuel is also very friable; and this would not be at all satisfactory in a gas-fire. The cheaper fuel appears to approach nearer the toughness of the ordinary form of ball fuel; but in the heating test, it did not give such a good account of itself as the ordinary fuel, though the consumption of gas was slightly less.

A digest of this report was sent to the inventors of "Radiant," in order to give them an opportunity of commenting upon the results of the tests before any publication was made. No remarks have been received from them; and they have not even acknowledged the receipt of the letter. We therefore publish the results as they stand.

THE LARGEST BONUS.

By Sir George Livesey.

[Extracts from an Article in the "Co-Partnership Journal" of the South Metropolitan Gas Company.]

A bonus of 9¾ per cent. on salaries and wages amounting to over £42,000 is about to be distributed. It is considerably the largest amount yet declared, and it would buy 140 houses at £300 apiece. The Directors are glad to believe that it will be wisely used; and that being so, it is a pleasure to them thus to show their sympathy with, and their goodwill towards, all classes of their employees. The Directors feel that during the last sixteen years they have done all in their power to make the

co-partnership a success; and they have pleasure in renewing the assurance that so long as the results are satisfactory, they will do their part to maintain the system.

The Board now consists of nine Directors, of whom six are elected by the 10,395 ordinary shareholders owning over £6,000,000 of stock, and three are elected by the 3163 employee shareholders who have stock in their own names—besides those whose stock is in the names of the trustees—who together own about £200,000. The latter therefore, own about one-thirtieth part of the capital, and elect one-third of the Directors. The reasons for this disproportion are that it was thought better not to wait until the employees acquired a larger amount of stock, that it was better to have two Workmen Directors than one, and as the officers must also elect a Director there are now three, who, as fairly as possible, give the shareholding employees of the six stations a share in the responsibility of the general management of the Company.

When the question of Employee Directors was first considered, there was the fear that they might take a narrow view of their duties. Even the late Mr. Mundella, with whom I sat on the Labour Commission, and whose sympathies were strongly with the workmen, had this fear; for, on consulting him on the subject, he said he approved of the idea, and would like to see the experiment tried. But he was not sure that Workmen Directors would take a broad view of their duties, consider all interests, and do their best for the Company as a whole. There was the risk that they might regard themselves as simply the representatives of their class, and consider that there their duties began and ended. Well, the Directors and shareholders took that risk, and have had no cause to regret their action. If the Employee Directors had taken the narrow view of their position, the Employee Director scheme would have failed, and would not have been renewed in 1901. There would have been no true Co-partnership, for its most important feature—namely, partnership in responsibility and in the management of the business—would have been lacking. If the Employee Directors had not taken their right position as guardians of all three interests—shareholders, consumers, and employees—we could not have changed our profit-sharing to co-partnership, and, in fact, total failure would have been very near. I think the Directors would have lost heart—I am sure I should; and the employees, having lost the opportunity given them of sharing in responsibility and management, could not have had another chance. Shareholders and consumers could have justly objected to the payment of the large annual bonuses; and no satisfactory defence being possible, the end must have come.

Co-partnership is neither philanthropy nor charity, but business; or, as a Member of Parliament, who had adopted the system, once said to me, "business up to date"—that is, the foremost and best method of uniting Capital and Labour. Consequently, although the first bonus was a gift, it was only to show the way, and given in the hope and expectation that the recipients would give hearty service in return for value received—that, in fact, they would earn the bonus by doing their best for their employers. It is only on this ground that co-partnership can be a success; and therefore it can only in this way be maintained. This rests entirely with the employees. The Directors have done their part by giving the start, and making arrangements for working. The officers—especially the two Chiefs, all the Engineers, the Honorary Secretary, and his assistants—and those officers and foremen who work the co-partnership, have also done their part well, and kindly and sympathetically; neither time nor trouble being spared. I think I may say they have their reward in the gratitude of many of the co-partners and the belief that good has been done. But all would have been in vain if the great majority of the co-partners had not also done their part well. Again I say, the future of our co-partnership rests entirely with the employees, for so long as they earn the bonus and wisely use it, success is certain and assured.

I have said that the Directors would not be justified in continuing the Co-partnership if an equivalent in hearty service is not given for the bonus, which must not be regarded as a gift to the employees. There are gifts that are justifiable, and which the Directors gladly give; and I must ask you to bear with me while I enumerate them simply for information, and not in any sense in a boastful spirit. The Directors recognize that it is their duty to show their sympathy with their employees by helping them with their various funds, by giving holidays with pay, by providing recreation rooms and grounds, subscriptions to hospitals, &c. The contributions for these purposes amount to a large total. Last year the amounts of these gifts, without the bonus, were—

For superannuation for officers, and superannuation and sick pay for workmen	£10,055
Holidays for workmen	14,585
	£24,640

In addition, a large sum was expended on the provision of recreation and club rooms at Vauxhall, in officers' salaries during holidays, on recreation grounds, subscriptions to hospitals, convalescent homes, &c. I do not include the subscription to the accident fund, because the law requires it, nor the extra quarter of an hour for breakfast, because I do not believe it entails any loss, although it amounts to one-and-a-half hours a week, or 78 hours, or about one-and-a-half weeks, in the year. All told, there is a large total money value, which I can assure you is given cheerfully, and with the hope that it adds to your pleasure and comfort, and is a help in times of sickness, distress, and old age.

PERSONAL.

We are asked by Mr. John F. Simmance, of Messrs. Alexander Wright and Co., Limited, to announce that Mr. JACQUES ABADY has resigned his position as Managing-Director of the firm, in consequence of having been called to the Bar. He, however, retains his holding of shares in Messrs. Alexander Wright and Co., and has been elected on the Board as an ordinary Director.

St. Stephen's Church, Wandsworth, was the scene of the marriage last Saturday week of Miss GERTRUDE OCTAVIA KIMBER and Mr. FRANK HARDING JONES. The bride is the third daughter of Mr. and Mrs. Edmund Kimber, of Shooter's Hill, and niece of Sir Henry Kimber, Bart., M.P.; and the bridegroom the second son of Mr. H. E. Jones, M.Inst.C.E., and the partner of his father's professional work at Westminster. Mr. Stanley Jones, the Engineer of the Commercial Gas Company, performed the office of "best man." Both bride and bridegroom have an extensive circle of friends in Wandsworth; and the church was thronged with an interested audience. Subsequently there was a reception at Sir Henry Kimber's house, Lansdowne Lodge; there being a large and fashionable attendance to personally wish the happy pair all the good things that they could themselves possibly desire. The wedding presents were not only numerous but beautiful and costly. Mr. Jones, by his affability, has won for himself many friends in the gas industry; and they will unite with us in the cordial wish that both bride and bridegroom may be endowed with the greatest happiness and favours of life.

OBITUARY.

The recent death is announced of Mr. F. N. HAYWOOD, a prominent burgess of Accrington, who had filled the office of Mayor, and was Vice-Chairman of the Gas Company before the gas and water undertakings were transferred to the present Board. He was in his 76th year.

Many of our readers, especially those who are members of the Southern District Association and of the Evening Star Lodge, will learn with regret of the recent death, in his 55th year, after an illness of five weeks, of Mr. ARTHUR MEAD. Death was due to valvular disease of the heart following congestion of the liver and the lungs. Deceased was articled to the late Mr. Jabez Church, sen., the Engineer and Manager of the Chelmsford Gas Company, on whose death Mr. Mead succeeded to the position, which he held till 1890. Of late years he had not been closely identified with gas-works management. He joined the British Association of Gas Managers in 1873, and was a member of the Council of the Gas Institute; but his connection with that body ceased on the formation of the Institution. He was admitted in 1876 into the Institution of Civil Engineers, of which he was an associate member. He leaves a widow, three sons, and three daughters.

Commercial Photometry.

In "Technics" this month, there is the second article by Mr. John F. Simmance, Assoc.M.Inst.C.E., on "Commercial Photometry;" and students will find that the matter does not lose in interest right to the end. Mr. Simmance discourses in a manner which clears away all technical obscurities; and, in the few columns which he has occupied with his subject, he has so plainly told of the apparatus and methods involved that little else but practice is required to make a photometrician of the reader. His contribution this month is divided into three sections—"Testing the Quality of Gas;" "Testing Incandescent Gas or other Burners and Electric Lamps in the Horizontal;" and "Testing at an Angle." In dealing with the various methods of attaching an illuminating value to gases, the author expresses an opinion which has present interest. He says: "Adjusting the flame to a certain height and then fixing the illuminating power and the rate of gas consumption, is perhaps the fairest to all gases, because it always permits of the burner being used under the same conditions. A 16-candle flame of coal gas might be 3 inches, a 16-candle flame of water gas might be 2 inches, and of mixed coal and water gas (say) 2·5 inches. It is obvious that these different flames are getting unequal amounts of air on account of their different areas; and therefore the tests are not made under similar conditions. It is better, therefore, to make all tests at a fixed height. The flame height which has, in practice, been found to be most consistent is between 3·5 inches and 4 inches. The use of this method is quite simple and is strongly recommended, particularly where water gas is used."

Manchester and District Junior Gas Association.—By permission of the Gas Committee of the Hebden Bridge and Mytholmroyd Gas Board, the Engineer and Manager (Mr. E. J. Wellens) has been able to arrange for an inspection of the gas-works next Saturday afternoon by the members of the above-named Association. At its conclusion, they will drive to Dawson City, calling at the electricity works on the way to see the 250-horse power gas-engine. From Dawson City rail will be taken to the reservoir of the Halifax Corporation.

THE NEW THREE-AND-A-HALF MILLION CUBIC FEET GASHOLDER AT AMSTERDAM.

A Gasholder Tank with a Storehouse and Railway Passing Underneath.

One of the papers submitted to the Gas Section of the International Engineering Congress, held in Glasgow in the autumn of 1901, was by Heer J. van Rossum du Chattel, who described "The Principles of Construction of a Proposed Modern Gasholder for Amsterdam;" and since then the work referred to has become an accomplished fact. The holder (which was erected by Herr Klönne, of Dortmund) has now been in use for more than a year; and the following translation of an illustrated description of the structure by Heer R. A. van Sandick, which has appeared in "De Ingenieur," will form a useful supplement to the particulars given by Heer Rossum du Chattel.

Introduction.

The Municipality of Amsterdam had, in 1901, to face the question of how they could increase the storage capacity at the West Gas-Works. There were there three holders of 22,000 cubic metres each, with brickwork tanks sunk in the ground; but the maximum daily consumption of gas amounted in 1901 to 125,000 cubic metres. This figure rose in 1902 to 136,000 cubic metres, and in 1903 to 153,000 cubic metres. The annual production of the West Gas-Works rose from 22 million cubic metres in 1901 to 29 million cubic metres in 1902, and 30 million cubic metres in 1903; the total output of the West and East Gas-Works together being 58 million cubic metres. The decision was in favour of an iron annular tank construction, by which the total weight would be reduced as much as possible, and the large space (60 metres diameter) under the gasholder could serve as a store-room (fig. 1), which is entered through gates, and the open space of which suffices for a railway siding.

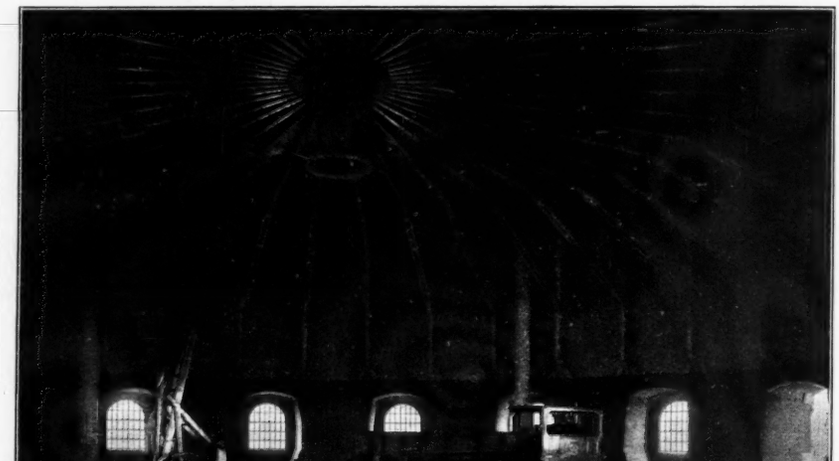


Fig. 1.—The Store under the Gasholder.

(*Photographed Jan.* 8, 1904.)

Before the foundation was made, the ground was filled up with watered sand. By this means, the subsoil was compressed. The sand and subsoil were then dug out from 1 M. + A.P. (Amsterdam level) to 1·90 ÷ A.P. Next a foundation of 2764 piles was driven in, on the average 14·5 metres in length. On these piles were laid a wooden floor and a concrete annular disc, strengthened by 16 iron beams. From the circular disc at the centre of the tank, spokes of concrete and iron go to the ring itself. Hence the foundation when seen from above looks like a gigantic wheel, the fellies and spokes of which rest on piles. On the concrete annular disc an annular brick wall has been made, 7 metres high, in which 40 openings (fig. 2) have been formed, having the same profile as the free space of a railway. The annular wall begins at 1·50 metres below the level of the ground and rises to 5·65 metres above ground. The 40 pillars between the openings are connected by heavy walls with 18 large windows through which the interior of the tank, which serves as a store-room, is well lighted. The top of the annular wall is covered with a layer of asphalte, in order to protect the bottom of the tank against moisture.

On the annular wall the iron annular tank is placed (fig. 2), the outer wall of which consists of riveted iron sheets of 32 millimetres thickness at the bottom, and the inner wall of sector sheets (fig. 3). In the inner space of the tank four lifts are immersed, of which only the upper one is covered (fig. 4). These lifts fit into each other with U-shaped cups, and rise to a total height of 57 metres above the ground level (figs. 5 and 6). The top of the tank is 15 metres above the surface level of the ground. This roof consists of iron plates, riveted water-tight, and resting on 40 beams measuring 28·5 metres from centre to circumference, and hinged to 40 vertical struts and 40 braces, hinged at both ends. The central ring is free, and does not rest on a pillar. It weighs 55 tons. In the construction 2300 tons of iron, 1427 cubic metres of concrete, and 2,300,000 bricks were used.

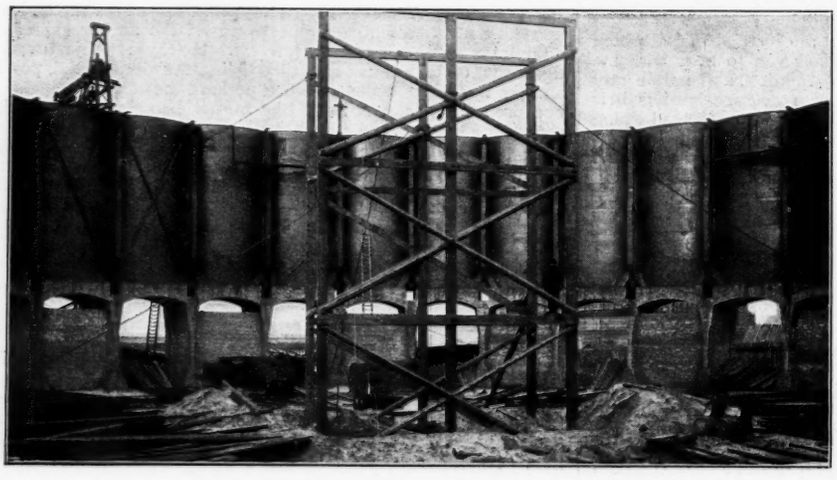


Fig. 2.—Annular Tank on March 21, 1903.

(The Scaffolding in the Centre is ready for the Construction of the Roof.)

Details of the Holder.

Fig. 7 shows the manner in which two telescopic lifts grip each other with the edges of their cups. Fig. 8 shows details of the upper rim of the fourth or outer lift. The drawing exhibits the radial roller-guides by means of which the lift moves up and down along the vertical guides. Fig. 9 is a horizontal section of the annular tank. At a short distance from the outer wall inside the tank, 40 vertical stays are placed, of which one is visible in section in the drawing. The four lifts are indicated as they stand in the tank in their lowest position. The inner wall of the tank consists of cylindrical plates, of which 40 occur in the circumference of the circle. The cylindrical lateral walls have a diameter of 4 metres; and their centres lie outside the gasholder. Two consecutive cylinders are joined against the head of a vertical rail, which is attached to the flange of a heavy stay. This latter is one of the 40 trusses which are placed at equal distances on the annular wall of the gasholder, and which together form the main part of the support of the so-called roof.

Fig. 10 is a vertical section of

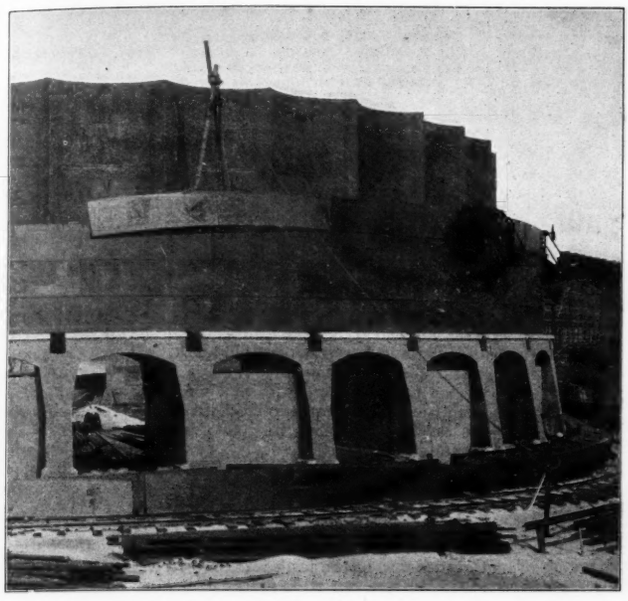


FIG. 3.—INNER CASING OF THE ANNULAR TANK FINISHED.
The Fourth Course of Sheets of the Outer Casing in Course of Construction.
(*Photographed March* 21, 1903.)

the annular tank with the lifts in it. This drawing shows clearly the manner in which the lifts in their lowest position are entirely free from each other and rest on the floor of the tank. With the inner lift a small part of one of the curbs of the Schwedler cupola is visible, above which the covering sheets are riveted. Finally, the drawing shows the top and bottom part of one of the 40 mainstays, and a small portion of one of the 40 radial supports of the roof. The roof consists of iron sheets, 6 millimetres thick, riveted water-tight; and near the outer circumference it possesses a circular vertical rim, 40 centimetres high, by which a certain depth of water on the roof is obtained. The tank and roof are both filled with water to a depth which is maintained in order not to disturb the necessary equilibrium between the external forces caused in the whole iron construction by the pressure of water and gas.

Fig. 11 gives one of the 40 constructions which together carry the roof and take up the lateral pressure of the tank. At the lower end, the brace (which is also shown in vertical projection) is connected with the flange of the strut by means of a heavy steel bolt, admitting of a pivoting motion. Also, at the upper end, the brace admits of a slight hinged motion. The radial horizontal supports meet in a single ring, as is shown in projection in a separate sketch.

Fig. 12 is the horizontal section of a main-stay. This drawing explains the construction of the vertical stay, and the manner in which the rail is attached to the outer flange. There are two main-stays for the cylindrical interior wall of the tank; the plates forming the inner wall being placed between the consecutive stays.

Fig. 13 is a horizontal section of the rail, with the inner wall supported by it, and with part of the stay.

Fig. 14 gives the vertical sections of the upper parts of the lifts in their lowest position. It shows the radial and tangential roller-guides of the lifts against the bar of the guide-framing. Fig. 15 furnishes an idea of the roller-guides of the fourth or outer lift in projection and elevation. The adjustment of the tangential guides is clearly visible. Fig. 16 shows the third lift in projection and elevation. Fig. 17 illustrates the roller-guides of the second lift in projection Fig. 18 is reproduced from a drawing of the roller-guides of the first or inner lift. Fig. 19 shows the bottom parts of the lifts, with the roller-guides on the bars attached to the inside of the lifts. Fig. 20 is a horizontal section of the wall of the first (inner) lift, and of the third lift, both taken above the rims of the bottom cups. These sections show the vertical H-irons, which serve for the roller-guides.

TRIAL AND WORKING.

From Dec. 2 to 13, 1903, the filling with water, inflation with air, deflation, and filling with gas took place in succession. The following is from a report on these operations by Heer J. J. C. Hardenberg, the Joint Engineer.

Introduction.—In order that the operations may be clearly understood, it may here be mentioned that the holder consists of four lifts, having diameters of 58, 58·80, 59·60, and 60·40 metres

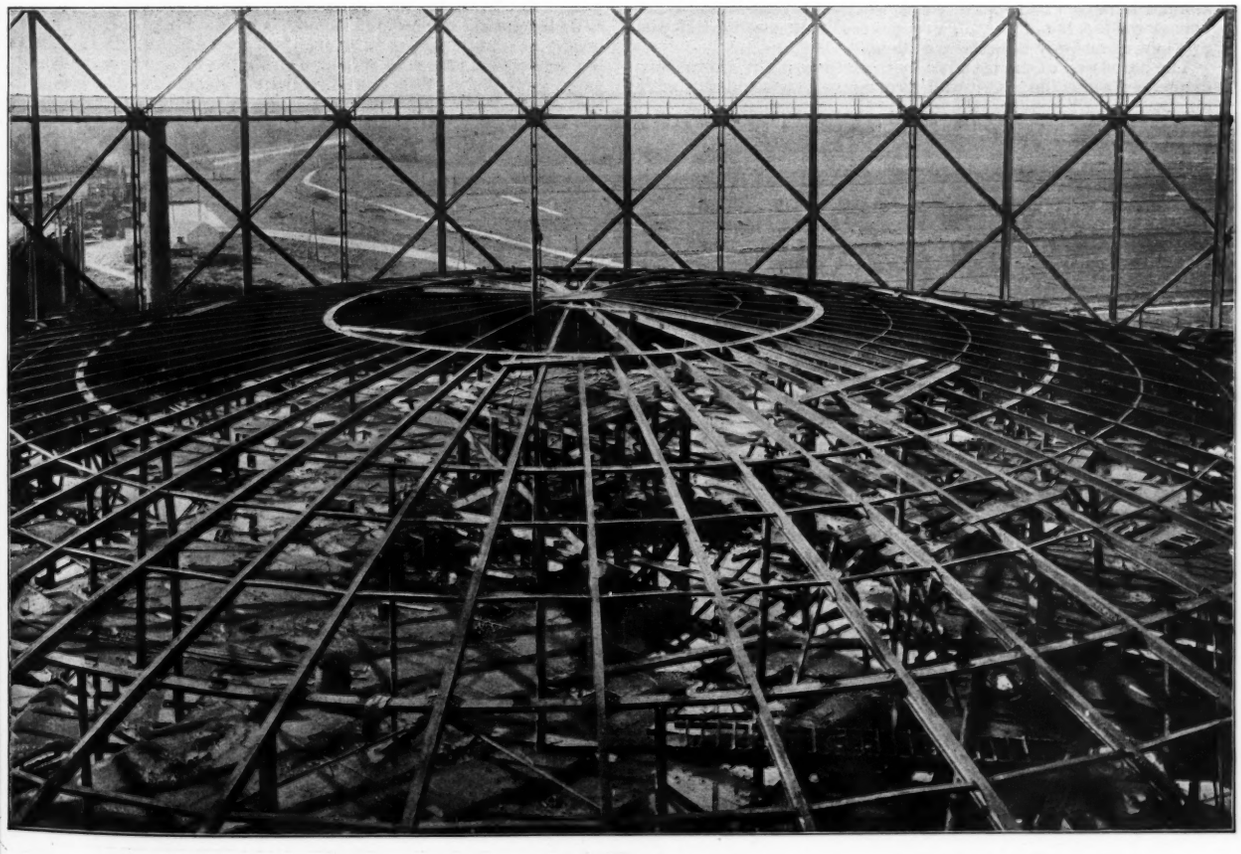


FIG. 4.—SCHWEDLER'S CUPOLA FOR COVERING THE INNER LIFT IN COURSE OF CONSTRUCTION.
(*Photographed Sept.* 16, 1903.)

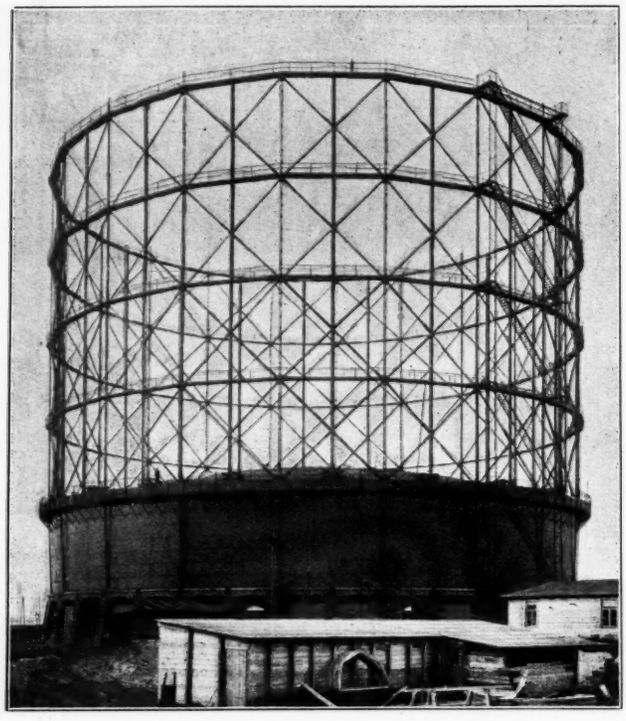


FIG. 5.—THE FRAMING OF THE NEW HOLDER.

respectively. The inner lift is closed above by sheet iron of 2 millimetres thickness. This has the shape of a spherical segment, 4·833 metres high, and is supported by a Schwedler truss construction. The heights of the lifts are 9·684, 9·084, 9·084, and 9·084 metres. To this is added $\frac{4{\cdot}833}{2} = 2{\cdot}416$ metres for the crown. The maximum height is, therefore, 39·352 metres. When all the lifts are in the lowest position, they are enclosed in an annular tank 9·88 metres high, and, where the vertical stays are placed on the annular wall, 2·03 metres wide (see fig. 21), and 2·73 metres midway between the stays.

The outer wall of the tank is a cylinder 61·30 metres in internal diameter; while the inner wall is composed of segments, 40 in number, placed between the stays. These segments are 9·15 metres high, and are in horizontal section circle segments of 4 metres radius, 4·50 metres chord, and 0·70 metre high.

Water-Filling.—Before explaining the water-filling, it will be necessary to consider the main construction and the dimensions of the tank and roof (fig. 22). The roof is also the floor of the gasholder. Fig. 23 is a sketch of this construction. The heavy beams *a a* support the roof; and *b b* are supporting beams meeting the centre block. Vertical stays *c c* are placed on the annular wall and carry the beams *a*. The walls *k k* are between the stays *c*. The roof becomes a tank for water by a cylindrical brim *g g*; and *e e* are braces the extremities of which admit of a pivoting motion taking place with changes of pressure. The principal dimensions are indicated in metres.

In order to study the distortions which the filling of the tank in successive stages would produce both in the tank and in the roof *f f*, the roof was simultaneously filled with water. Of course, these fillings required some care. Excessive filling of the tank causes an outward bending of the walls *k* (see fig. 5), by which the brace *e* will be forced up in the direction of the arrow, and the roof will be distorted. Moreover, too great bending tensions will then possibly arise in the construction. If at a certain moment too much water is on the roof, the walls will be bent in the opposite direction—*i.e.*, inwardly—by the downward pressure of the braces. Hence it was important that the filling should take place in such a way that the tank should be filled to a height of 9·58 metres at the same time as the roof was filled to a height of 0·40 metre. The filling required—

Annular Tank—

(*a*) For the space enclosed between two cylinders of 30·65 and 28·62 m. radius: $(30{\cdot}65 - 28{\cdot}62) \times 9{\cdot}58 \times 2\pi \times 29{\cdot}635$	=	3625 cub. metres
(*b*) For the volume of the bulges, height 9·15 m.: $\frac{8}{3} \times 4{\cdot}5\,(0{\cdot}7 + 0{\cdot}089) \times 9{\cdot}15 \times 40$	=	865 ,,
(*c*) For the annular space *above* the roof enclosed between the radii 28·62 m. and 27·85 m. and 0·40 m. high $(28{\cdot}62\text{-}27{\cdot}85) \times 0{\cdot}4 \times 2 \times 28{\cdot}235 \times \pi$	=	55 ,,
Total		4515 cub. metres

Roof—

Cylinder of 27·85 m. radius and 0·40 high, $27{\cdot}85^2 \times \pi \times 0{\cdot}4$	=	975 cub. metres
From this we must subtract the circular centre with a radius of 1·14, high 0·25 m., $1{\cdot}14^2 \times \pi \times 0{\cdot}25$	=	1 ,,
		974 cub. metres

Thus the filling of the roof and tank had to take place in the ratio of 974 to 4545, or 1 : 4·67, assuming that the quantities of water required for the distortion of the roof and tank are equal.

The filling in this ratio was effected by means of a filling-box (fig. 25) constructed on the roof near the edge. This filling-box had an outer wall, being part of the continuous circular wall of the roof (see also fig. 23). The four walls, *ab*, *bc*, *cd*, and *ad* are 0·43 metre high. In the walls *ab* and *cd* incisions were made 3 centimetres deep and 4·67 and 1 metre long (see above). The water poured into the filling-box would thus flow regularly into the tank and on the roof through the openings *ef* and *gh*. Water from the Vecht was supplied by a 6-inch pipe, which, near the holder, branched into two 4-inch ascending tubes, ending in bends beside each other above the open space of the filling-box at *i* and *k*. The pipe *i* ended immediately in the box; while the pipe *k* was coupled to 4 metres of piping in order to allow of the filling of the tank and roof separately, if necessary.

In order to follow the course of the filling, the water on the roof and in the tank was gauged at intervals. At the same time, seven rods (gas-pipes) were suspended from the roof inside the space under the gasholder. Rods Nos. 1, 2, 3, 4, 5, and 6 were suspended at the extremities of six heavy beams (fig. 26), where the lighter beams begin. Rod No. 7 was suspended from the centre. At the lower end of each of the rods, a nut and counternut was screwed on. Moreover, the upper surfaces of the nuts were ground even, in order to obtain suitable points for observation. At P is a pillar of about 2 square metres base, and at *p* a small pillar. The masonry of these two pillars rests on the concrete ring in the ground at the centre of the holder, as part of its foundation. On the pillar P a levelling instrument was mounted, with which the heights of the upper surfaces of the nuts Nos. 1 to 7 were periodically observed with respect to a bolt cemented on to the surface of the small pillar *p*. The upper surface of this bolt *p* therefore served as a fixed point of reference.

As soon as the construction of the holder had so far advanced that it needed no further support, the roof appeared to bend 6 centimetres under its own weight. It was therefore decided to so far modify the method of filling that the tank was filled to a height of about 3 metres before the roof received water. The bending was at first very small. During the filling the water was gauged on the roof in four directions, extending radially from the centre; the object of these gaugings being to follow the

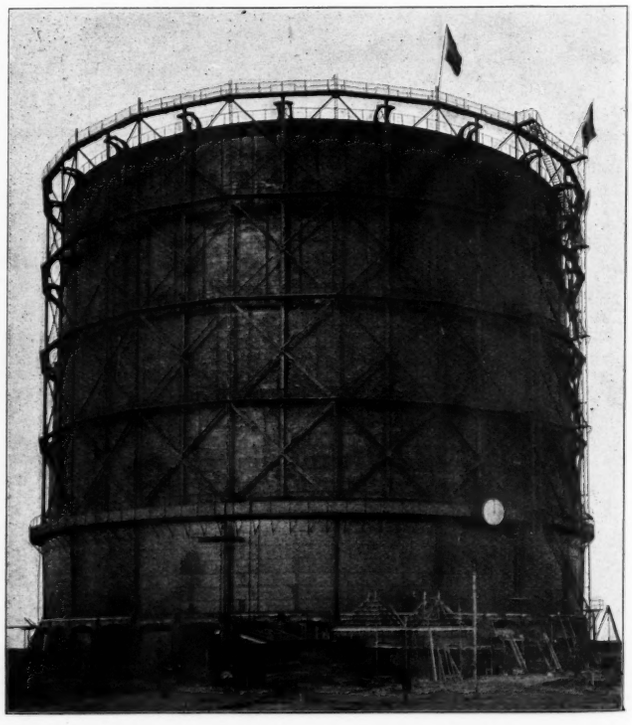


FIG. 6.—THE GASHOLDER INFLATED WITH AIR.

(*Photographed Dec.* 12, 1903.)

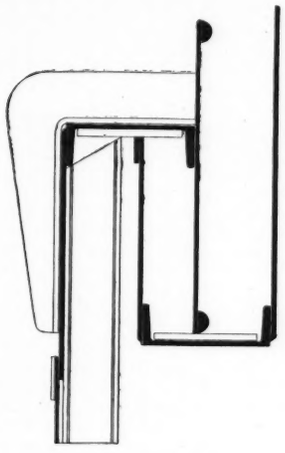


FIG. 7.—GRIP OF TWO TELESCOPIC LIFTS, WITH EDGES OF CUPS IN CONTACT.

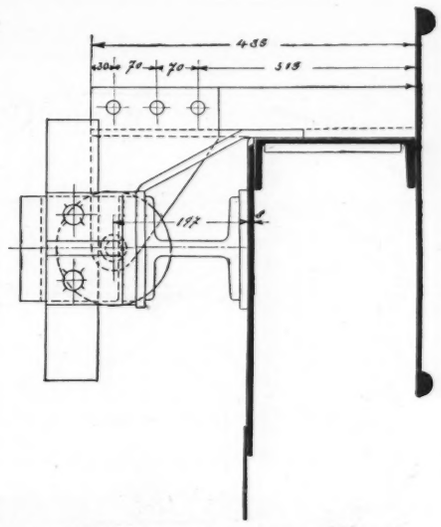


FIG. 8.—DETAILS OF THE FOURTH OR OUTER LIFT.

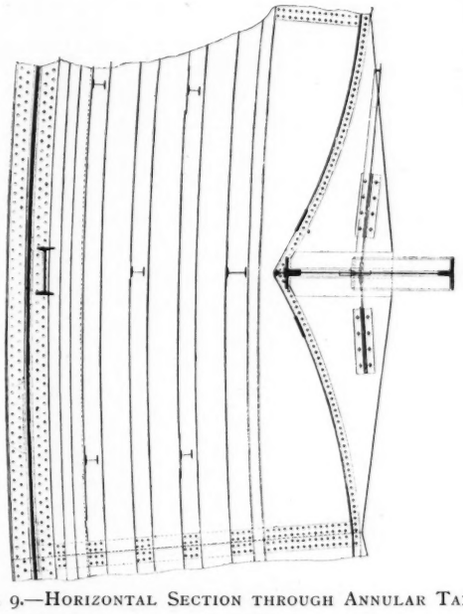


FIG. 9.—HORIZONTAL SECTION THROUGH ANNULAR TANK.

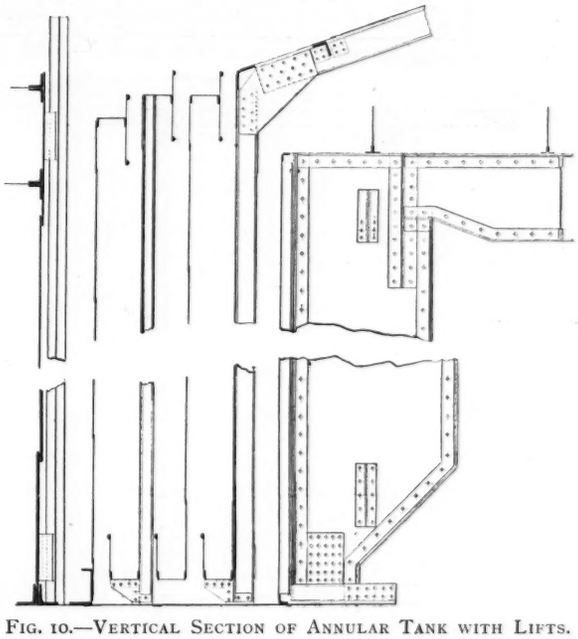


FIG. 10.—VERTICAL SECTION OF ANNULAR TANK WITH LIFTS.

distortion of the roof as a whole. As a rule, the filling was continued through the night, and took place at the rate of 55 cubic metres per hour.

During the working, care was taken that the water-columns on the roof and in the tank remained normal—*i.e.*, within set limits. The water-level in the tank can easily be controlled daily, since a strong iron staircase leads to the first platform, which lies at the same height as the upper rim of the tank, and where the level can be measured directly from the upper edge of the outer wall (9·88 metres above the floor of the tank). Long-continued rain might do harm, especially as all the rain water falling on the top of the inner lift reaches the tank. In order to drain the superfluous water, a vertical tube is placed inside the tank, the upper end of which corresponds to the highest desired water-level.

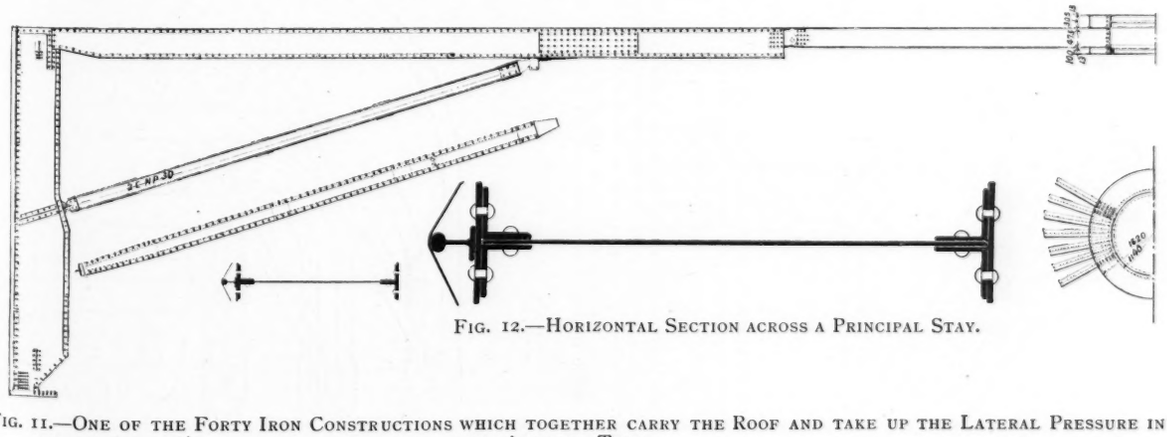


FIG. 12.—HORIZONTAL SECTION ACROSS A PRINCIPAL STAY.

FIG. 11.—ONE OF THE FORTY IRON CONSTRUCTIONS WHICH TOGETHER CARRY THE ROOF AND TAKE UP THE LATERAL PRESSURE IN THE ANNULAR TANK.

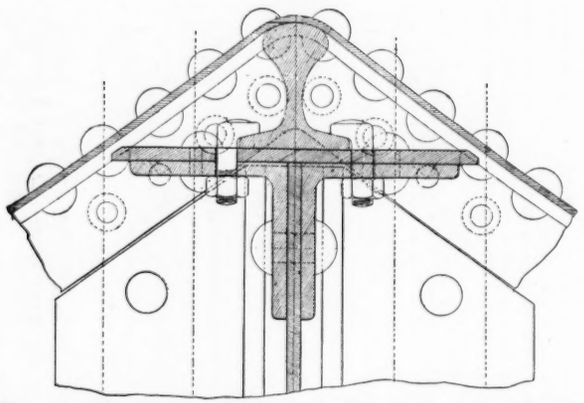
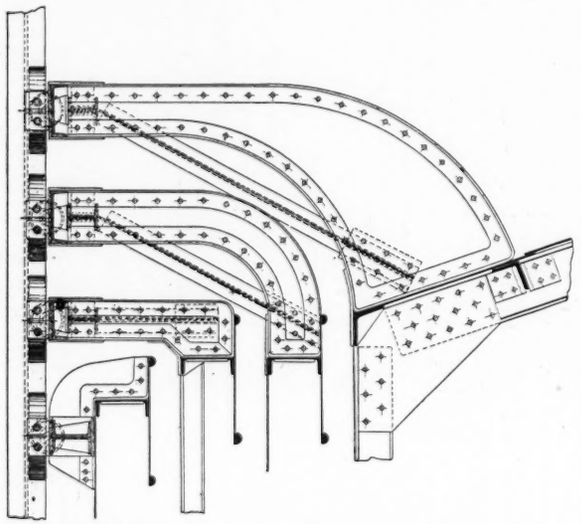


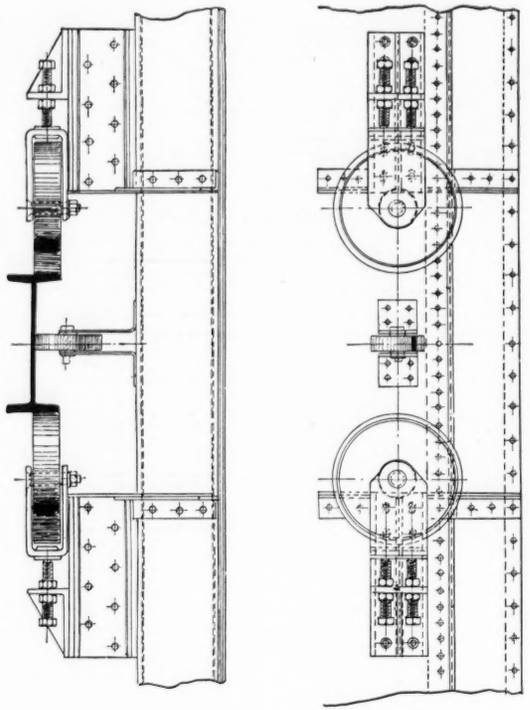
FIG. 13.—HORIZONTAL SECTION OF THE RAIL, SHOWING THE CONNECTION WITH THE INNER WALL AND WITH PART OF THE STAY.

The tube pierces the side of the tank, and discharges the water. Continuous drought may necessitate the replenishing of the water, for which purpose a tube of small diameter suffices.

Conditions are different with the roof, which, of course, is inaccessible during the working. Two ½-inch pipes are placed



14.—VERTICAL SECTION OF THE UPPER PARTS OF THE LIFTS IN THEIR LOWEST POSITION.



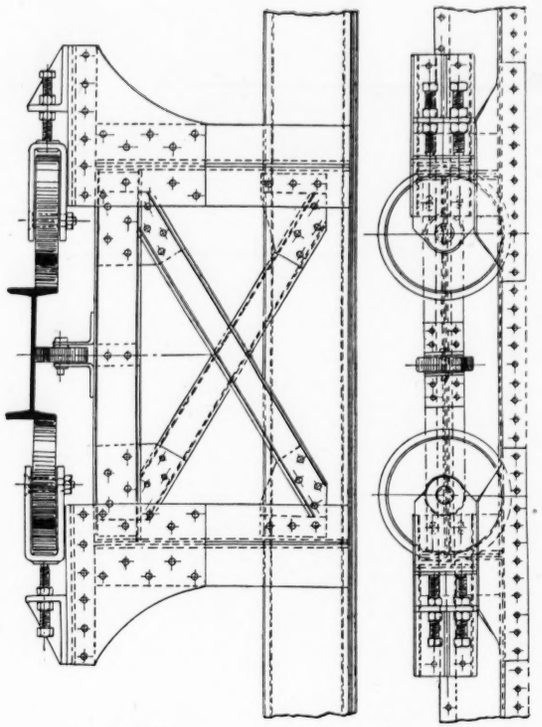
View from Above. Front View.

FIG. 15.—ROLLER-GUIDING OF THE FOURTH OR OUTER LIFT.

vertically, piercing the roof, and having their ends above it—one at the desired water level, and the other 5 millimetres higher. Both lead to the syphon-house of the holder, and thence into a closed space, and have small cocks at the end. When the cocks are opened, one must give gas and the other water. The superfluous water is let off; while if there is too little, one of the 3-inch valves on the top of the holder must be opened, and water be added by means of a bent tube and a funnel. On account of the results of the bending of the roof, it was judged advisable, after inflating the holder, to reduce the column of water on the roof from 40 to 38½ centimetres; and the two pipes mentioned were consequently shortened 1½ centimetres each.

The filling began on Dec. 1, at 10.15 a.m., and was generally continued during the night with a supply of 30 to 55 cubic metres per hour. It was completed on Dec. 7, at 2 p.m. About 5421 cubic metres of water from the Vecht were necessary; the remainder being supplied by snow and rain.

Inflation with Air.—The inflation, so as to test the tightness of the lifts, was commenced on Dec. 8, in the forenoon, and was

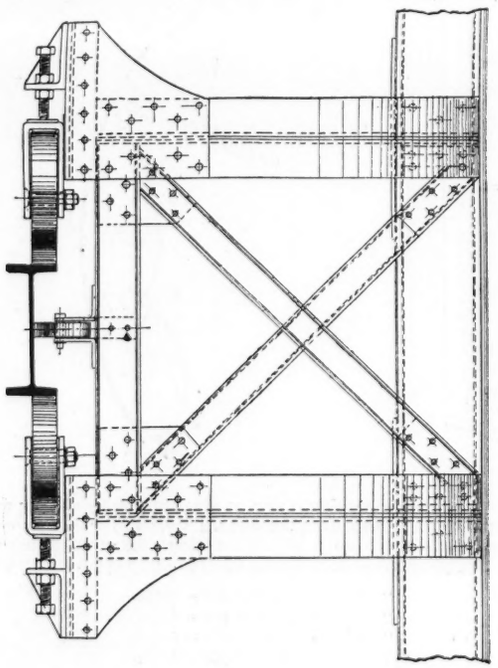


View from Above. Front View.

FIG. 16.—ROLLER-GUIDING OF THE THIRD LIFT.

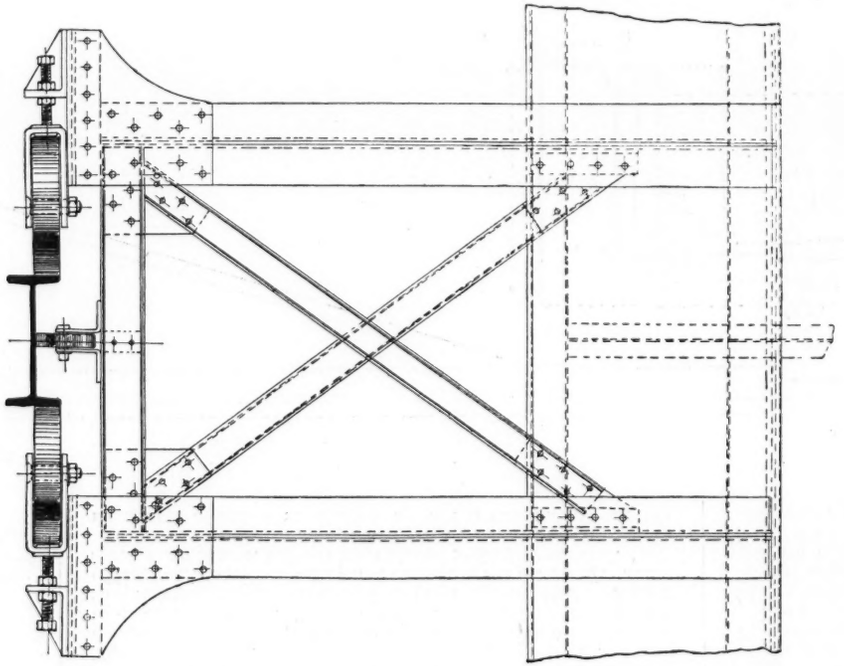
accomplished by an exhauster, operated by steam from Babcock boilers. These boilers, which serve for heating the holder during frost, are installed in a separate boiler-house. During inflation, heights were measured in continuation of the observations while filling with water. The rise shown by the roof during the last period of the water-filling partially disappeared. The natural cause of this was the pressure exerted on the roof by the inflated lifts. When the rising of a lift had commenced, the position of the roof proved to remain unchanged; and only after stoppage was a small rise of 1 to 2 millimetres observed. The inflation lasted four days, and was stopped at night each time before the next lift would be gripped, so as to permit of measuring in the morning the bending caused by the grip.

In connection with this report, diagrams were given showing the pressure of the air in the rising lifts. They were recorded by an indicator which communicated with the interior of the inlet of the gasholder by means of a rubber tube. Theoretically the pressures of the successive "floating" lifts may be found as explained next page.

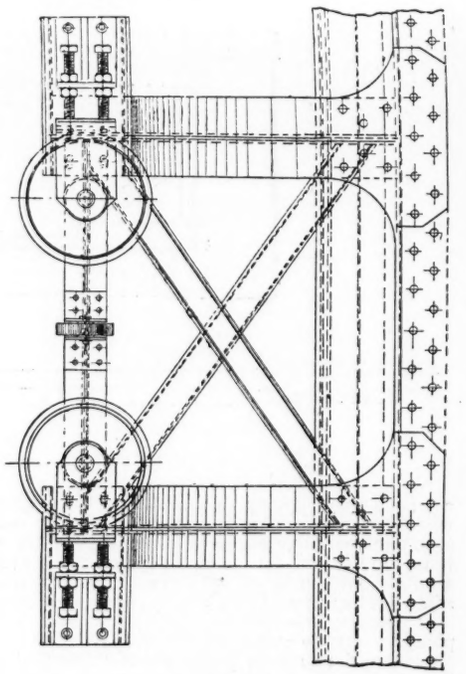


View from Above.

FIG. 17.—ROLLER-GUIDING OF THE SECOND LIFT.



View from Above.



Front View.

FIG. 18.—ROLLER-GUIDING OF THE INNER LIFT.

The weight of the inner lift is	303·100 kilogrammes.
The weight of the two inner lifts, with the water of the cups, is	436·320 ,,
The same of the three inner lifts.	554·550 ,,
The same of the four lifts	671·077 ,,

The surfaces of the bases of the lifts are 2642, 2715, 2790, and 2865 square metres; consequently the pressures in the four successive stages of inflation with air are—

(1) $\frac{303{\cdot}100}{2642} = 114{\cdot}7$ mm.

(2) $\frac{436{\cdot}320}{2715} = 160{\cdot}7$ mm.

(3) $\frac{554{\cdot}550}{2790} = 198{\cdot}7$ mm.

(4) $\frac{671{\cdot}077}{2865} = 234{\cdot}2$ mm.

Curves showed only small deviations from these figures, and were fairly regular. The oscillations which they showed may be attributed to wind gusts, since, when there was no wind, no oscillations were visible on the paper.

The lifts rose without disturbance; only occasionally the guide-rollers touched the vertical bars. When the rivets were soaped, relatively few leaks were found; and these were made tight by caulking. It appeared unnecessary to inflate the holder a second time after the air had been let out. The actual trial of the holder could thus be considered as finished.

Deflation of the Air.—The deflation of the air commenced on Dec. 12, at 11.15 a.m. At 1 o'clock in the afternoon, the fall of the lifts was about 20 centimetres per minute. The outlet of the exhauster, by means of which the inflation of the gasholder was accomplished, corresponded in dimensions to a free section of 490 square centimetres.

Filling with Gas.—The filling with gas took place, with the necessary precautions, on Dec. 13. The inlet-pipe has a diameter of 1 metre, and ends in a syphon-house, which forms an appendix of the holder, and in which both inlet and outlet pipes are controlled by means of four valves. The two pipes pierce the annular wall of the holder, and rise vertically above the water on the roof. In order to prevent gas leaks, they are double-walled as far as they are visible in the interior space; the interspace between the two walls having been filled with water during the filling of the tank and the roof.

Fig. 27 shows the inner lift in its lowest possible position. The inlet is double-walled. The hydraulic seal is riveted against the lower side of the crown; while the supply of gas can be opened or shut by a valve. When the lift is raised by the gas, the hydraulic seal rises above the water level, after which the supply becomes gradually quicker. At the outlet-pipe the same construction has been applied (fig. 28), only the bent pipe and valve are wanting there.

The unworkable capacity of the gasholder—being the space in the inner lift which is above the water when the holder is in its lowest position—is equal to the volume of the crown. This is—

$$\frac{1}{6}\pi h\,(32^2 + h^2)$$

$$= \frac{1}{6}\pi \times 4{\cdot}833\,(3{\cdot}29^2 + 4{\cdot}833^2) = \text{. . .} \quad 6444 \text{ square metres}$$

to which is added the volume of the disc—

$$0{\cdot}104\,M = 0{\cdot}104 \times \pi \times 29^2 = \text{. . .} \quad 275 \text{ square metres}$$

Unworkable capacity space = . . . 6719 square metres

For filling with gas, the air had to be expelled from this space. Near the centre 3-inch valves are found, which are opened for the escape of air through vertical tubes, ending at a short distance above the water level. After a few hours, the escaping mixture

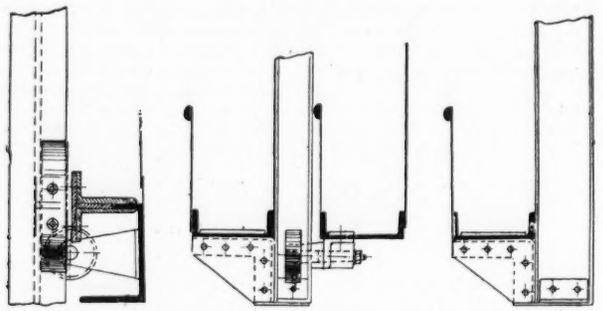


FIG. 19.—DETAILS OF THE LIFTS WITH ROLLERS ALONG THE GUIDES ATTACHED TO THE INNER FACES OF THE LIFTS.

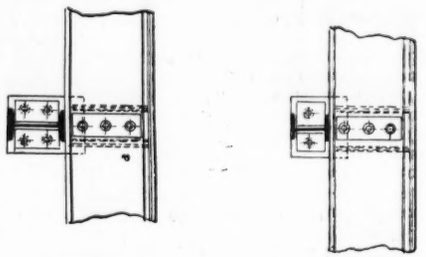


FIG. 20.—HORIZONTAL SECTION ABOVE THE EDGES OF THE BOTTOM CUP.

appeared to be no longer explosive; and the valves were then shut, and the rising began.

The theoretical pressures caused by the successively rising lifts are in the case of filling with gas (see above)—

$$114{\cdot}7 - 0{\cdot}8 \times 12{\cdot}1 = 105{\cdot}1 \text{ mm.}$$
$$160{\cdot}7 - 0{\cdot}8 \times 21 = 143{\cdot}9 \text{ ,,}$$
$$198{\cdot}7 - 0{\cdot}8 \times 30{\cdot}16 = 174{\cdot}5 \text{ ,,}$$
$$234{\cdot}2 - 0{\cdot}8 \times 39{\cdot}24 = 202{\cdot}8 \text{ ,,}$$

the factor 0·8 is derived from the difference in weight of a cubic metre of air = 1·3 kilogramme, and a cubic metre of gas = 0·5 kilogramme. On Dec. 17, the air had also been expelled from the inlet-pipe, and the holder was ready for use.

CONCLUSION.

In conclusion, some reference may be made to the experience gained since the holder has been in use. In the course of July, 1904, in the interior space of the holder, tangential deviations were observed, where the braces are attached to the stays (fig. 10). These were thereby deviated from their vertical positions. These deviations to the left (−) and to the right (+) amounted to − 112 to + 100 millimetres. They were caused by the high temperature to which the iron construction had been exposed in the summer of last year, combined with small defects in the mounting. Some stays, for instance, had not been placed absolutely vertical.

Shortly after the deviations had been noticed and accurately measured, means were devised by which the stability of the structure should be assured. For this purpose tension-rods were prepared, of which two were placed crosswise in each section. Each rod consists of two parts, connected by a socket with right and left handed threads. The lower as well as the upper end is hammered flat and riveted to the flanges of the stays. By means of the sockets and tension-rods, the stays in which deviation had occurred were replaced. This auxiliary construction had the effect of greatly strengthening the holder, while they convey the impression that they are essential parts of the design. Since a force of about 3000 kilogrammes was sufficient for replacing the deviations, the repair could be effected in the very simple and inexpensive manner explained. There is no fear that the accident will be repeated; so it may be said that the whole construction, barring the deviation just mentioned, has given proof of its solidity, and that there is no fear for the future. This also applies to the foundation, which has proved to be firm and unyielding.

The community of Amsterdam are now building another gasholder of this construction, of 6000 cubic metres volume, at the East Gas-Works.

In order to prevent freezing of the water in the annular tank, a complete system of tubes conveys steam from two Babcock and Wilcox boilers to the holder. These boilers are placed in a house built at a distance of 40 metres from the holder; and they also furnish the steam for the three gasholders mentioned earlier in the article. The tubes are all above the ground level; and the condensed steam is conducted back to the boilers by means of a novel apparatus called a "Meteor," which is operated by steam, and is reported to be working very well indeed.

The steam system works as follows: (1) For warming the water in the tank, two Körting's jets are placed on the annular tank for the supply of water mingled with steam, which is delivered into the tank. (2) For the warming of the store-room, there is a circular tube of 2 inches diameter with ten bends for expansion and twenty warmers regularly placed at the inner side upon the

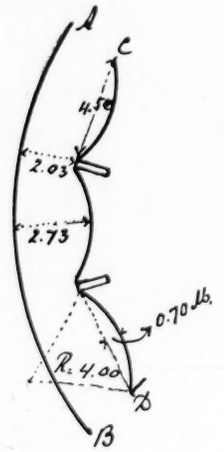
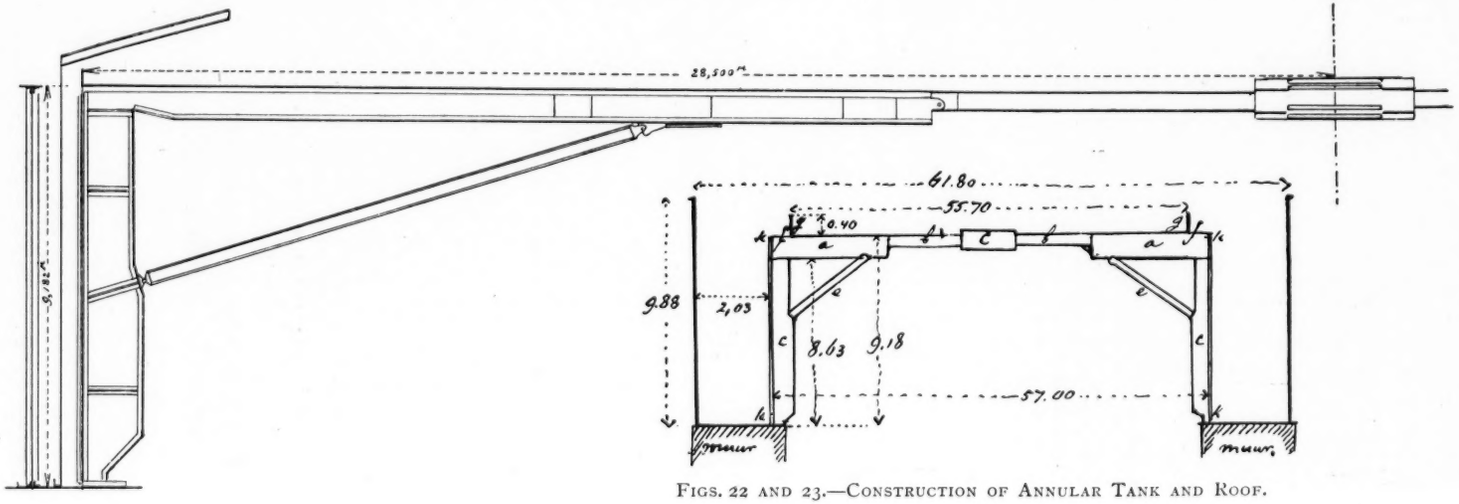


FIG. 21.—ANNULAR TANK.



FIGS. 22 AND 23.—CONSTRUCTION OF ANNULAR TANK AND ROOF.

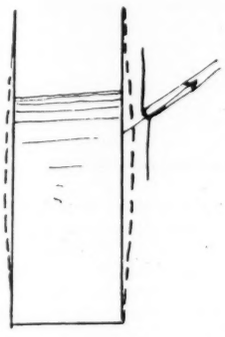


FIG. 24.—BENDING OF THE TUB-SHAPED WALLS IN CASE OF OVER-FILLING OF THE ANNULAR TANK.

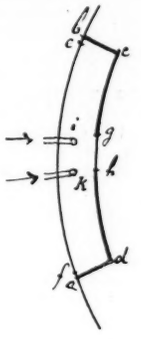


FIG 25.—FILLING BOX ON THE ROOF NEAR THE EDGE.

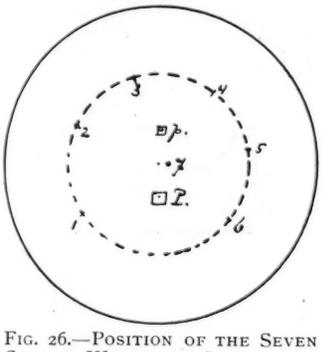


FIG. 26.—POSITION OF THE SEVEN COLUMNS WITHIN THE SPACE UNDER THE GASHOLDER.

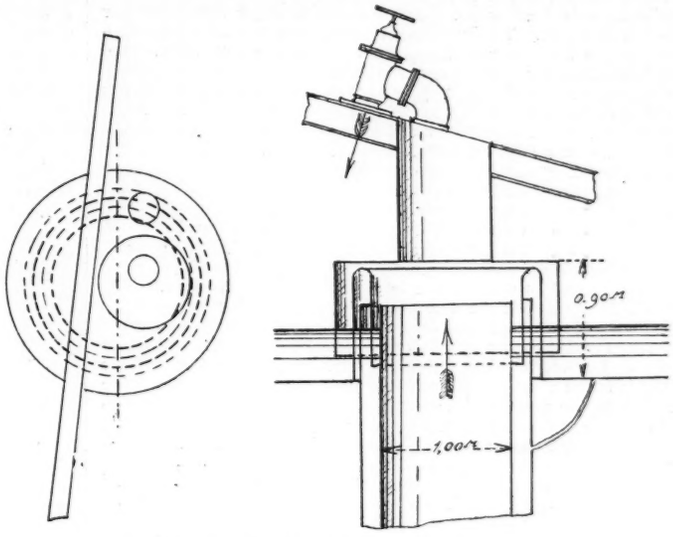


FIG. 27.—INLET IN SEALED CONDITION.

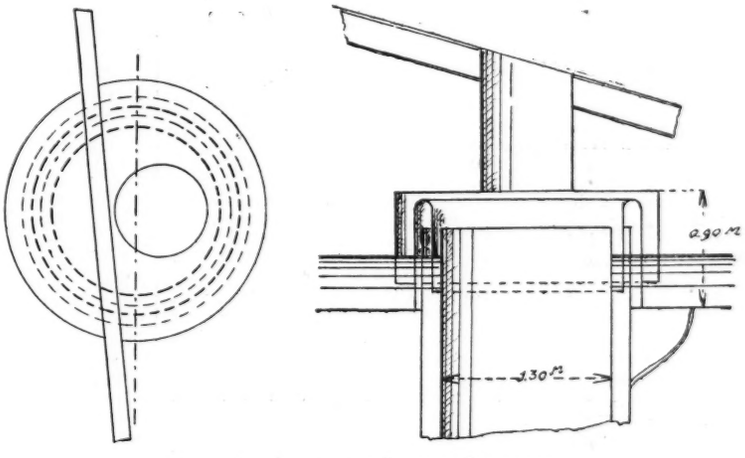


FIG. 28.—OUTLET IN SEALED CONDITION.

wall. (3) There are three tubes of 3 inches diameter for warming the cups, provided with Körting's jets to warm the water in the three cups. These jets are on the same system as those already mentioned. (4) For ventilating the store-room, a Körting ventilator is placed in the axis of a vertical tube 750 millimetres wide, working as a chimney for getting out the air from the higher parts of the store-room. The replacement of the air under the roof of the tank, when necessary, is accomplished by means of a tube from the roof, which communicates with the chimney by a syphon passing through the wall. The condensed water gathered at the bottom of the chimney can be pumped out by a 1½-inch pipe..

GAS COALS AND THE PRODUCTS OF THEIR DISTILLATION.

By M. SAINTE-CLAIRE DEVILLE,

Engineer of the Experimental Works of the Paris Gas Company.

[Extracts from a Lecture delivered to the Pupils of the College of Mines.*]

I propose in this short lecture to show you what are the relations which exist between the elemental composition of the coals suitable for the manufacture of illuminating gas, and the quantity or the quality of the various products of their distillation. In order to make the comparisons which bring these relations into evidence, it is necessary to have carried out, on a considerable number of samples, first an organic analysis, and secondly an industrial test. It would be natural, therefore, to divide this lecture into three parts: (1) The organic analysis of coals. (2) The industrial test. (3) The statement and discussion of the numerical results.

It is hardly necessary to speak to you here of the organic analysis of coals. This operation is familiar to you, and the improvements which have been made during the last twenty years in the equipment of laboratories render uninteresting any description of the processes which I used from 1872 to 1875 in carrying out about 200 analyses, the results of which have enabled me to establish a certain classification of gas coals, based alike on their composition and on the nature of the products of their distillation. I must tell you, however, that this work was commenced under the direction of our illustrious comrade, Victor Regnault—the first scientist who succeeded in making a sound organic analysis of coal. He published, in 1837, in the "Annales des Mines," a work which has remained a classic, and to which I shall have to refer later on. During the last years of his life, Regnault was Consulting Engineer to the Paris Gas Company. He continued in his duties till his final illness; and it is thus that I am able to claim the honour of being his last pupil. Without dwelling further, therefore, upon the organic analysis, we will consider the industrial testing of coals as it has been practised from time immemorial at the Company's works.

To test a coal is simply to manufacture gas from that coal during three consecutive days in works specially equipped for measuring and judging the quality of all the products of the distillation. This establishment, which is called an experimental gas-works, is not merely a laboratory. The works possess a bench of four settings of seven retorts each, identical with those of the large works at La Villette, of which they form an annexe. Of these four settings there are never more than two in action. Each feeds a complete series of gas-making apparatus. [The lecturer described the several portions of the plant.] There are, in reality, two experimental works absolutely identical with each other, and even arranged symmetrically. Two different coals can therefore be tested at the same time, if desired. In practice, it is found preferable to make two simultaneous tests of the same coal, and thus obtain two reports which act as a check on each other. This duplicate arrangement, moreover, admits, in case of need, of the testing of a new process of distillation, condensation, purification, &c.

Let us now follow step by step the carrying out of a coal test made in duplicate, and upon which two reports are drawn up—Nos. 1 and 1A. A test lasts three days, and is begun on the Monday and Thursday of each week. Four (or five) waggons of coal of 10 tons are required for the complete test; and they are discharged in the yard of the works. The first operation consists of taking a sample for the primary analysis, which is to show the content of water in the coal by the hygrometer, then of the volatile matters and ash per 100 kilos. of dry coal. The charge per furnace is 1000 kilos. (2204 lbs.), divided between the seven

* Translated from "The Bulletin de l'Association amicale des Élèves de l'École national supérieure des Mines."

FIG. 21.—ANNULAR TANK.

retorts, or an average of 143 kilos. (315 lbs.) per retort. The distillation lasts four hours. Therefore six charges are made per day of 24 hours. The retorts are charged at regular intervals—two at the beginning of the four hours, two an hour after, three 2½ hours after the first charge, and so on. The settings are heated with the coke produced from the coal, and their temperature is higher or lower according to the quality of the coke. The heats vary from about 1580° to 1706° Fahr., and are taken once a day by means of a calorimetric pyrometer with nickel index. The furnaces are fitted with an improved pressure-gauge which indicates and registers the degrees of vacuum above the fuel bed. The pointer falls to zero whenever the furnace door is opened. Every operation which the stoker may perform during his working hours is shown by a special wave in the curve. This apparatus is particularly useful for controlling night work.

Each retort is drawn four hours after being charged. The production of coke from a complete charge of 1000 kilos. is divided into four separate classes according to size. Each class is weighed and also measured by volume. In calculating the yield of coke by volume, the total of the large, medium, and small coke only is taken; the quantity of fine dust being disregarded. To ascertain the yield by weight, the contents of a retort, of which the charge of coal was first weighed with special care, are drawn into an extinguisher, or closed vessel, and the weight of their contents with respect to 100 kilos. of coal gives the proportion of the fixed matters found in the process of distillation on a commercial scale. This figure will be always higher than that obtained by distillation in the platinum crucible (primary analysis). These operations are carried out on the first, second, and third days of the test; and the average results are entered in the report.

Having followed the gas from the retort through the various pieces of apparatus constituting the testing plant, the lecturer said: Finally we come to the station-meter and to the testing of the gas. A sample of the production is taken from only five out of the six charges, as it is necessary to reserve a few hours for examining the contents of the two gasholders. This is done on Tuesday and Wednesday, and on Friday and Saturday, from one to five o'clock. A system of mains delivers the gas simultaneously (1) to the photometric laboratory, where the illuminating power of the gas coming from the two plants is simultaneously measured by comparison with the same lamp; (2) to a Regnault balance, for determining its specific gravity; (3) to a Junkers calorimeter, by means of which its calorific value is measured; and finally to the special laboratory, where the primary analysis and the weighing of the benzol are carried out.

It is impossible for me, in so short a lecture, to explain to you, even briefly, the processes employed to determine these different properties of illuminating gas. It remains for me to give you some indication as to the form in which the report of the test is drawn up, and then to proceed to examine the results in comparison with those of the elemental analysis. The report comprises:

1.—*Examination of the Coal:* Classification according to size; percentage of slate; content of water by the hygrometer; volatile matters in the large, small, and (by calculation) unscreened coal; the weighing of the sulphur in the coal, which is of particular interest in this connection.

2.—*Examination of the Gas:* Yield of gas by volume and consumption in litres per carcel at 50° Fahr. and 30 in. bar; density of the gas at freezing-point and at 30 in. bar; calorific value per cubic metre, at constant pressure and with water evaporated, at 50° Fahr. and 30 in. bar; primary composition of the gas per 100 volumes—benzol (aromatic series), ethylene hydrocarbons, formic acid (and nitrogen), hydrogen, carbonic oxide, carbonic acid, and oxygen; special analysis by weight of the carbonic acid and benzol; sulphur from the sulphuretted hydrogen in the impure gas, in weight per cubic metre.

3.—*Condensation:* Tar from each of the condensing appliances, in weight per 100 kilos. of coal and per cent.; ammoniacal liquor ditto, with statement of aerometric density of each of the liquors; weight per 100 kilos. of coal and aerometric density of the water used for washing the gas; temperature in the hydraulic main and in the different condensing appliances; average of the meteorological observations taken during the test (thermometer, barometer, and hygrometer).

4.—*Coke:* Weight of coke in the extinguisher per 100 kilos. of coal; weight and volume of the coke quenched with water, with classification according to size.

5.—*Industrial Analysis of the Coal:* Example—

	Kilos.
Weight of the gas	14·931
Water of condensation	6·089
Tar	6·149
Coke (in extinguisher)	69·943
Loss	2·888
Total	100·000

The loss represents the carbon adhering to the retorts, the tarry substances cleaned out of the ascension-pipes, the sulphur and cyanogen left in the purifying material, &c.

Finally, a calculation is made, in regard to the gas, of the quantity of light per 100 kilos. of coal. This figure is obtained by dividing the production of gas by the consumption for one carcel. If we then multiply the result by 105, we have corrected the production to the prescribed illuminating power—that is to say, we have the volume of gas of the Paris standard, which is equivalent to the volume of gas actually obtained.

Let us now pass on to the comparison of the results of the working test with those of the elemental analysis. We will recall to mind, first of all, the conclusions arrived at by Regnault in his classical work on combustible minerals. He classified all these combustibles in the order of their geological age, and analyzed successively—

1.—Those of the great carboniferous formation, in which he distinguishes two stages: the transitional strata and the coal measures proper.

2.—Those of the secondary formation, in which he also distinguishes two stages. He retains the term coal, however, for both of them, although certain of the seams are often called lignites.

3.—Those of the tertiary formation, among which he distinguishes lignite proper and the bitumens.

4.—Those of the contemporary formation, such as peat, and, at the end of the scale, wood.

If we glance through the results of these analyses, we shall notice that, with a few exceptions, which are easily explained, the proportion of oxygen contained in the combustibles increases regularly in quantity from 2 to 3 per cent. in the anthracites and transitional seams to 25, 30, and 45 per cent. in the lignites, peats, and wood. The content of carbon undergoes a corresponding variation in the opposite direction. This being so, the coals which experience on the working scale has found to be suitable to the manufacture of gas all belong to the first class—that is to say, they are found in the great carboniferous formation.

Let us take the table in which Regnault gives a *résumé* of the particulars respecting coals of this category. We see that he subdivides them into the following five varieties:—

	Average Percentage of Oxygen and Nitrogen (deducting Ash).
1.—Anthracites	2·62
2.—Rich and hard coals	4·47
3.—Rich smithy coals	5·74
4.—Rich long-flame coals	8·89
5.—Dry long-flame coals	16·39

Of these varieties, there is only one—the fourth—which contains gas coals. It is true that small quantities of other descriptions of coal belonging to the third and fourth categories are carbonized in our works; but they are only used for making up mixtures.

The Regnault classification does not, therefore, distinguish between different coals used in the gas industry. Accordingly, if we wish to group these coals into different classes, it is necessary to create a subdivision, which, as already indicated, can only be based upon the content of oxygen. This is what has been done, and we have arrived at the following classification of the coals:—

	Oxygen and Nitrogen Per Cent.
Type I.	6·56
,, II.	7·66
,, III.	8·71
,, IV.	11·10
,, V.	12·70

To recapitulate, the experimental works classify the coals into five types, which are distinguished by their decreasing geological age. The percentage of oxygen contained in the coal is adopted as the criterion of age in preference to the percentage of carbon, for the reason that the former influences in a more direct and striking manner the composition of the products of the distillation of the coal.

Upwards of 200 samples of 45 different descriptions of coal were analyzed from 1873 to 1875; while at the same time the coals were tested on the working scale in the furnaces of the works. It was thus possible to determine in a very positive manner what are the results of distillation which depend essentially on the elemental composition of the coal; and so well has this been done that on seeing the report of the practical trial we are now able, if not exactly to specify the precise elemental composition of the coal, at least to recognize, without analysis, in which of the five above-mentioned definite types the coal should be classed.

The analyses were made of average samples, which, however, had been freed with the greatest care of all visible mineral impurities, such as slate, pyrites, &c. In these conditions, the ash contained in the samples taken never exceeded 3 per cent. The drying of the samples before analysis was effected by leaving them for a certain length of time under cover in the presence of sulphuric acid. The hydrogen and carbon were weighed; nitrogen was taken at the invariable figure of 1 per cent.; and the content of oxygen was estimated by the difference. All the figures were besides brought to the proportion of 100 of combustible matters (ash being deducted).

The coals which were analyzed were classified as follows:—

In Type	I.,	those containing	5·0 to	6·5	per cent.	of oxygen
,,	II.	,,	,, 6·5 ,,	7·5	,,	,,
,,	III.	,,	,, 7·5 ,,	9·0	,,	,,
,,	IV.	,,	,, 9·0 ,,	11·0	,,	,,
,,	V.	,,	,, 11·0 ,,	13·0	,,	,,

Then, by calculating the average for each type, the following table was obtained:—

Elemental Composition of Coal (Ash being Deducted).

—	Type I.	Type II.	Type III.	Type IV.	Type V.
Hydrogen . . .	5·06	5·37	5·40	5·53	5·64
Carbon	88·38	86·97	85·89	83·37	81·66
Nitrogen . . .	1·00	1·00	1·00	1·00	1·00
Oxygen	5·56	6·66	7·71	10·10	11·70
Total . . .	100·00	100·00	100·00	100·00	100·00

It is very evident that these figures are in no way decisive. They are experimental data which might have shown slightly different results if certain of the coals had not been tested, or if other coals which have not passed through our hands had contributed to the average.

As I have remarked, the working test has always accompanied the analysis; and examination of the results of the two operations has brought out the following general rules.

1.—The percentage of aqueous vapour contained in the coal increases from Type I. to Type V. In other words, the coals containing the most oxygen—that is to say, those which hold the most water in combination—are also those which most readily absorb and retain moisture. This, however, does not prevent certain coal seams, of equal elemental composition, from always yielding a higher percentage of aqueous vapour than others.

2.—The proportion of volatile matters (ash deducted) increases from Type I. to Type V.; and if we deduct the weight of the water in combination from the weight of the volatile matters, we find that the difference, or weight of the volatile hydrocarbons, is also in the ascending scale.

3.—The percentage of ash does not appear to be connected with the elemental composition of the combustible portion of the coal.

4.—The yield of gas, brought to 100 kilos. of combustible matter (ash deducted), reaches its maximum in Type I. to Type III. It tends to diminish from Type III. to Type V.

5.—With regard to the composition of the gas, we notice that the proportion of light-giving hydrocarbons, and particularly of those which belong to the ethylene series, increases regularly from Type I. to Type V. The percentage of formic acid, or more exactly the proportion of formic acid to the hydrogen, also increases. As regards the carbonic oxide and carbonic acid, as can be easily foreseen, they both show very distinctive increases from Type I. to Type V.

6.—The density of the gas increases from Type I. to Type V. This results necessarily from the variations in composition.

7.—The illuminating power (measured by the Dumas and Regnault photometer) is very weak in Type I., moderate in Type II., good in Type III., and better still in Type IV. But it ceases to increase in Type V.

8.—The quantity of light per 100 kilos. of coal results from the combined variations in the yield of gas and in the illuminating power. It reaches its maximum in Types III. and IV., which include the best gas coals.

9.—The calorific value follows generally about the same variations as the illuminating power. Nevertheless there is no necessary relation between these two quantities. The fact is that, in passing from Type I. to Type V., the heat-giving elements increase with the light-giving ones. It should be noted, however, that the gases which leave the retort at the end of the charge may have no illuminating power whatever, and yet possess very important calorific value. As the two quantities do not become extinct together, they cannot obviously be regarded as bearing any theoretical proportion to each other.

10.—With regard to the condensations, a regular progression is observable in the content of tar, and particularly of ammoniacal liquor.

11.—Finally, the production of coke, in weight and quantity, diminishes in passing from Types I. and II., which include the rich smithy coals, to the succeeding types.

12.—The greater the percentage of oxygen in the coal, the greater will be the quantity of condensable vapours given off, and particularly of aqueous vapour. Consequently, the average temperature at the outlet of the hydraulic main and in the collector increases from Type I. to Type V.

It may be said, in recapitulation, that the greater the quantity of hydrocarbon constituents contained in a coal, the richer that coal will be in the constituents containing oxygen—that is to say, in water of combination. The latter in distillation produces a kind of water gas mixed with carbonic acid. In these conditions, the richness of the gas in light-giving hydrocarbons increases from Type I. to Type V. But the disturbing influence of the water gas shows a similar progression; and it is noticeable that after Type IV. the illuminating power ceases to increase. We should doubtless see it decrease if we distilled lignite coals containing even more oxygen than those of Type V.

It is essential that I should point out that certain of the rules I have enumerated are only apparent if the different types of coals which are being compared belong to the same coal basin, or at least to the same region. For example, in an important basin the percentage of carbonic acid in the gas varies from 1·5 to 2·9 from Type I. to Type IV. (Type V. is not represented there.) In another region the percentage of carbonic acid in the gas varies from 0·6 to 1·6 in passing similarly from Type I. to Type IV. This is due to the fact that in the former of the two regions the strata adjacent to the coal seams are usually rich in the carbonates of iron and lime. If we deduct from the percentage of carbon compounds containing oxygen the carbonic acid weighed directly in the pulverized coal, the anomaly disappears, and the influence of the organic oxygen appears the same for all the basins. To be able, therefore, to recognize to what type a coal belongs, it is well to have some idea as to its origin.

In the following table are given, in a condensed form, the results of 1812 coal tests carried out during twelve years (1887-1898), and relating to the products of 58 different mines or pits. In its preparation, use has been made of the summaries of coal tests which it is our custom to draw up every two years.

—	Type I.	Type II.	Type III.	Type IV.	Type V.
	Averages for the Regions A and C	Averages for the Regions A, B, and C.			Averages for the Regions C.
	Per Ct.	Per Ct.	Per Ct.	Per Ct.	Per Ct.
Volatile matters (ashes deducted)	28·652	32·753	35·102	38·261	42·115
Products of distillation per 100 parts of coal distilled—					
Gas	13·271	14·054	14·931	15·950	14·349
Water of condensation . .	4·204	5·109	6·089	8 152	14·370
Tar	4·556	5·486	6·149	6·929	7·547
Coke (in quencher) . . .	75·294	72·188	69·943	66·570	60·872
Sundries and losses . . .	2·675	3·163	2·888	2·399	2·862
Total	100·000	100·000	100·000	100·000	100·000
Volume of gas (at 50° Fahr. and 30 in. bar.) per English ton of 1015 kilos. of unscreened coal, c. ft. .	10,918	10,809	10,976	10,640	8,838
Consumption for 16 c.p. (at 50° Fahr. and 30 in. bar.), c. ft.	7·44	6·71	6·47	6·15	6·17
Illuminating power in standard candles	10·70	11·90	12·36	13·00	12·96
Value of gas per ton of coal in pounds of sperm . . .	400·53	440·86	465·13	474·24	392·71
Density of gas (at freezing point and 30 in. bar.). .	0·3368	0·3606	0·3803	0·4161	0·4485
Composition of the gas by volume—	Per Ct.	Per Ct.	Per Ct.	Per Ct.	Per Ct.
Benzol vapour	0·905	1·001	1·066	1·090	1·094
Ethylene hydrocarbons. .	2·430	2·810	3·198	3·858	4·403
Formene and nitrogen . .	31·790	32·730	32·829	32·919	32·004
Hydrogen	57·041	54·720	53·409	50·439	48·252
Carbonic oxide	6·379	7·074	7·615	9·106	10·702
Carbonic acid.	1·055	1·265	1·483	2·188	3·145
Oxygen	0·400	0·400	0·400	0·400	0·400
Total	100·000	100·000	100·000	100·000	100·000
Weight of benzol in grains per 100 cubic feet	1,474	1,631	1,736	1,775	1,781
Coke in pounds per ton . .	1,752	1,656	1,590	1,457	1,229
Temperature of the gas in the hydraulic main . . .	133° F.	135° F.	144° F.	154° F.	175° F.
Temperature of the retorts .	1655 ,,	1652 ,,	1648 ,,	1626 ,,	1599 ,,

For each coal the average has been calculated of the figures given on the last six summaries. The coals have then been divided into three large groups—A, B, and C—according to the geographical situation of the coal basin from which they were obtained. Finally, the coals of each group have been classified according to types. In Group A we do not meet with coals of Type V.; in Group B, Types I. and V. are not represented; and Group C alone comprises all five types. The consequence of this is that there is a slight want of homogeneity in the general averages of each type. But this is of slight importance.

The Proposed "Technolexicon."—According to a communication made to the "The Times" by Dr. Hubert Jansen, of Berlin, the compilation of the "Technolexicon" is being steadily proceeded with, though it appears doubtful whether the appearance of the work will be witnessed by the present generation. A period of four years has been occupied in obtaining the mere raw material; and a great deal still remains to be done before its preparation for the press is entered on. Dr. Jansen observes: "In the compilation of this universal technical dictionary for translation purposes (in the English, German, and French languages) that was commenced in 1901, about 2000 firms and individual collaborators at home and abroad are at present assisting. Up to now, 2,700,000 word-cards have been collected. To these will be added the hundred thousands of cards that will result from the working out of the original contributions not yet taken in hand. The contributions have been called in since Easter, 1904, and most of them have already come in." "The Times" remarks: "Whether the value of the completed work will correspond to the enormous toil involved in dealing with some 3,000,000 word-cards is perhaps a dubious question. But there is no disputing the praiseworthy enterprise of the Society of German Engineers in the initiation of the work, and in carrying it through on the enormous scale inferred from the above particulars."

GAS WORKERS' WAGES IN MOSCOW.

Introduction of the Premium System.

At the Congress of the Société Technique du Gaz en France, a paper on the subject of the new systems that have been introduced for remunerating workmen was read by Mr. HENRY LAMING, of Moscow. After pointing out that the payment of the ordinary day wage does not stimulate the worker to increased effort, and often converts a good workman into an inferior one, the author called attention to the "premium" plan, which is largely in use in America, and has been adopted on this side of the Atlantic, and explained its operation in the Moscow Gas-Works. The following is a translation of this part of the paper.

Our workmen are very poorly paid—from about 80 copecks to 1 rouble for the furnaces—*i.e.*, from 1s. 8d. to 2s. 3d. per day. We have maintained this normal wage, which is indispensable for the subsistence of the workman; but we have adopted the necessary measures for increasing it by daily bonuses calculated on economies effected in the manufacturing departments. For this we turned up what had been, during the preceding years, the average net cost of making gas. This having been ascertained, we found what increase of wages the application of the premium plan would permit, based on the percentage of the production of gas per furnace in 24 hours above the average. Some points of detail had to be worked out, such as the daily calculation of the premiums obtained. The decision was come to not to reduce the number of workmen employed per furnace, but to direct our efforts to improving the working of a furnace with the same hands; and, finally, it was decided to share the bonus equally. We then informed the employees that, starting from the next morning, their wages would be increased each day by a bonus calculated on the production of gas per furnace.

The new conditions of work were quickly understood. During the first month, the average production per furnace rose 6 per cent.; in the second month, 21 per cent.; and this figure has been further exceeded. Our workmen sometimes made as much as 14 to 20 copecks (4d. to 5d.) of bonus per day—entering with spirit into their work, and taking a pride in the good condition of the furnaces. These bonuses have never been any expense to the management, since they are simply one-half the saving realized by the extra production of the furnaces. Indeed, our monthly wage-sheets have, in spite of the payment of the bonuses, diminished to a considerable extent. In the second month after the new system had been adopted, the wages fell 9·8 per cent.; in the third month they had decreased by 12 per cent.—in other words, the wages per unit of production had decreased 24 per cent. So that the workmen were better paid, notwithstanding the considerable economy effected in wages. This fact will show the excellence of the system. This, however, is not all. We shall see that the works themselves derive benefit equal in importance to the extra money paid to the workmen in the form of bonuses. This result follows directly from the increased production of gas, which allows of fewer settings being under fire. The expenses of heating, charging, maintenance, and supervision are lower. It is well known that for every workman less in a factory certain general charges, such as insurance, sick benefit, &c., are reduced. These indirect economies in the case of Moscow have proved to be almost double those effected on the wages alone. A final advantage of no inconsiderable value is the fact that the task of the foreman becomes much lighter. With the men putting heart into their work, the foremen are able to give their time to the superintendence of the plant rather than to that of the men. At Moscow we have in winter 150 furnacemen; and with plant which is not the most modern, this opportunity of general supervision has been of great advantage.

I will conclude my notes in regard to the furnaces by giving in detail the calculations made each day to ascertain the bonus due to each workman:

Let A be the production of gas during the preceding 24 hours.
" B " wages of furnacemen during this period.
" $\frac{B}{A}$ " the net cost of furnace wages per unit of production.
" $\frac{B^1}{A^1}$ " net cost during recent years.
" N " number of furnacemen during the preceding 24 hours.

We shall then have—

$$\left(\frac{B^1}{A^1} - \frac{B}{A}\right) \frac{50}{100} \times \frac{A}{N} = \text{bonus per workman.}$$

That is to say, the difference between the net cost of wages per unit of production current on the day previous to that of making the calculation and the average price of preceding years (constituting the saving effected by the workmen) is multiplied by the production of gas the previous 24 hours, giving the total saving effected on the working. This saving is divided into two, and one-half is shared equally among the workmen.

We have applied this method to some other shops, and even to the foremen and clerks; and everywhere great economies have been at once realized. As the details vary with each shop, I will give as an example those relating to the meter-repairing shop, which is one of considerable importance. We first ascertained what was the net cost of wages per meter repaired during the preceding financial periods. As there is a great difference in meters, both as to capacity and description, we took as a unit the 5 and 10 light sizes, and, by arrangement with the workmen, we adopted the following coefficients for the other meters:—

5 and 10 light,	dry or wet	1·0 unit.
20	dry	1·5 "
20	wet	2·0 "
30	dry	2·0 "
30 and 50	wet	3·0 "
50 " 60	dry	3·0 "
80 " 100	dry	4·0 "

With these figures as a basis, it was found that each meter repaired had cost on an average for the preceding years, 1·63 roubles, or about 3s. 6d. in wages. The workmen were then informed that a moiety of the savings effected in wages per unit of repair would be divided among them. The wages immediately fell 30 per cent.

The following are the details of a fortnightly statement in roubles drawn up by the foreman:—

Meter-Repairing Shop—Dec. 1 to 15, 1904.

Wages, 72·10 roubles.

Working hours	520
Do. occupied for various purposes	11
Total hours taken for repairs	509
Meters repaired in 509 hours	93
Say in 520 hours	95
Net cost per unit repaired	$\frac{72\cdot10}{95}$ = 0·76 rouble.
Standard price	1·63 "
Saving per unit	0·87 "
Total saving for fortnight	0·87 × 93 = 80·91 roubles
Bonus for the workmen	80·91 ÷ 2 = 40·45 "

Division of Bonus Proportional to Wage.

Korotkoff	14·56
Ivan	10·76
André	7·22
Ciénine	2·14
Egor	5·77
	40·45

Meters Repaired brought to Unity.

5-light	dry	P.P.	3
5	"	"	12
10	"	"	4
20	"	"	2 × 1·5
30	"	"	4 × 2·0
5	"	wet	5
10	"	"	7
20	"	"	25 × 2
			93

It will be unnecessary to detail what has been done for the other shops. The principle in all has been the same—that is to say, to share with the workman the saving effected by his work. We have so far only applied it to economy in wages because it seemed the most simple to start with; but certain works, particularly chemical works, have enlarged the system by applying it to saving in material. This will not present any difficulty in gas-works, and it will stimulate our hands to work with intelligence and care, to the great benefit of the concern.

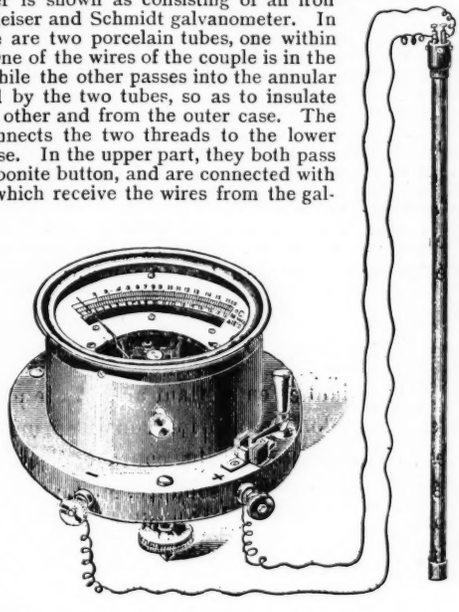
I cannot conclude this note without referring to certain criticisms which have been passed on our bonus system. The critics are neither the masters nor the employees. They are certain bodies of workmen and English Trade Unions who have raised a cry of alarm. The new method would appear to be defective because the wages would no longer be equally divided among all the workmen, for the idlers would be forced out as the supervision reached a critical stage. Our answer to this is that it is no longer possible either for employers or workmen to expect to work "at leisure." All our colleagues know what energy has to be put into their work in order that the business may progress. They ask of their workmen only the same energy and heartiness. To set against the increased labour of the workman there are his greater earnings and the well-being of his home. These should compensate him for any little extra fatigue he may have to endure.

PYROMETERS AND PYROMETRY.

As mentioned in the review of the proceedings at the Congress of the Société Technique which appeared in the "JOURNAL" last week, a paper describing certain pyrometers was submitted by M. Parsy. The subject was covered to an extent by Mr. John Bond, in his Institution paper, given in our issue for the 6th ult. The following is the substance of M. Parsy's communication.

Previous to 1895, the only instruments available for the measurement of high temperatures was the Salleron calorimeter, pyroscopes of fusible alloys, as used in the ceramic industry, and the pyrometric telescope of Mesuré and Nouël. The three pyrometers described in the present paper are those of Le Chatelier, Féry, and Wanner. The first is a thermo-electric instrument, the principle of which consists in measuring with a galvanometer the intensity of an electric current produced by the heating of a couple. The Le Chatelier instrument is greatly superior in practical work to others of its class. The couple, consisting of pure platinum and of platinum containing 10 per cent. of rhodium, is found to

give readings which are uniformly comparable. The complete couple, with wires of 0·5 mm. diameter, has a resistance of 2 ohms per metre, and is connected with a galvanometer of at least 200 ohms resistance. Until last year, the metals employed were not of sufficient purity; and the apparatus had to be standardized before each test. Now, however, the firm of Heræus, of Hanau (Germany), are able to supply couples of absolute purity—an advance which dispenses with standardization, and gives the pyrometer a real value in practice. In the accompanying illustration the pyrometer is shown as consisting of an iron case and a Keiser and Schmidt galvanometer. In the iron case are two porcelain tubes, one within the other. One of the wires of the couple is in the inner tube, while the other passes into the annular space formed by the two tubes, so as to insulate one from the other and from the outer case. The soldering connects the two threads to the lower part of the case. In the upper part, they both pass through an ebonite button, and are connected with two screws which receive the wires from the galvanometer.

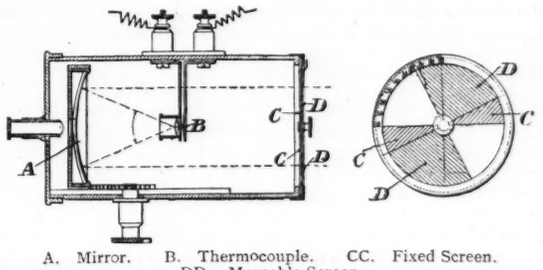


In practice the apparatus is very easily used, by inserting the case into the chamber of which the temperature is to be observed, and reading on the galvanometer a figure indicating degrees centigrade. The scale of these pyrometers ranges from ordinary temperature to that of the melting-point of platinum; but some precautions are needed for temperatures above 1000°. At these high temperatures the iron case, at a white heat, gets out of shape, and causes the fracture of the porcelain tubes. Consequently, it must not be kept in the furnace too long unless the case is supported, so as to keep it in shape. A clay tube is used for this purpose. Care should always be taken to avoid sudden changes of temperature. Before inserting the tubes in the furnace, they should be slightly heated, and on withdrawing them they should be allowed to cool as gradually as possible. A rupture of the lower tube is frequently of no importance, as this tube serves only to isolate the two wires.

One drawback to the instrument is that the platinum is finally carbonized, and has to be replaced after a certain period of use. There is also the possibility, at high temperatures, of the refractory materials becoming electrolytic, and thus giving rise to error. For medium temperatures, other metals than platinum can be employed. In this connection may be mentioned a pyrometer of this kind made by the firm at Poulenc, which is less costly and will stand more wear than a platinum couple. In principle it is identical with the instrument of Le Chatelier; but its scale is limited to 600° C. The pyrometer case contains the two insulated thermo-elements, one within the other, formed of iron and an alloy of copper and nickel. These metals produce a considerable electro-motive force, even for low temperatures. The elements are placed in a porcelain tube surrounded with asbestos, and the outer iron case encloses the whole.

This pyrometer is likewise constructed to indicate maximum and minimum temperatures. It is a pyrometric direct-reading galvanometer of the Le Chatelier type, fitted with a disc on the needle, by which contact is made between two terminals connected with a pile and a gong. Two screws are fitted for the maxima and two for the minima; and they are moveable, so that they can be placed to indicate temperatures which it is desired not to exceed or go below. With this apparent it is convenient to make observations on the temperatures of flues, and to usefully control the working of furnaces.

Coming now to the Féry pyrometer, which was described and illustrated in the "JOURNAL" for the 9th of May last (p. 360), and also by Mr. Bond in the paper that has already been referred to, an improvement has recently been made with the object of providing an instrument capable of measuring any temperatures on a greatly extended scale and with the same apparatus. The telescope has been provided with a butterfly diaphragm, cutting out radially a portion of the calorific rays. Further, the mirror is not silvered on the front (as in the old model), but receives a film of gold on the anterior surface—that is, on the surface directly acting as the reflector. Thus constructed, the apparatus follows the law of Stefan: "The quantity of heat radiated by a dark body is proportional to the fourth power of the temperature of the radiating body." This law does not hold good strictly when the calorific rays pass through glass, since the absorption of heat in the glass varies indefinitely with the temperature. The defect is remedied by reflecting the calorific rays directly from an unalterable



A. Mirror. B. Thermocouple. CC. Fixed Screen. DD. Moveable Screen.

THE FÉRY PYROMETER.

metallic surface. The quantity of heat reflected for the same temperature of the furnace is therefore greater than with the old model of telescope. The temperatures can be measured from 400° with the ordinary telescope, but with the butterfly fitting the same apparatus will measure any temperatures over 600°. The scale on the galvanometer corresponds to the full opening of the diaphragm. For higher temperatures, the butterfly must be turned through an angle marked on a graduated arc. The temperatures are then indicated in a table drawn up for this angle and giving readings as a function of the difference of potential of the junctions of a thermo-electric couple.

M. Parsy treats at length of the Wanner pyrometer, supplementing the outline of its construction given by Mr. Bond. This optical pyrometer is based on the experimental law of Wien and Planck, which defines the relation between the luminous rays emanating from an incandescent body and the temperature of that body. As the temperature is determined by a measurement of the light emitted, the instrument is actually a photometer. The light under examination passes through a slit and by means of a system of lenses and a direct-vision prism a spectrum is obtained, consisting, through the use of a diaphragm, of rays of a given wave-length. The intensity of the light is measured by polarization. At the end of the instrument pointed to the source of heat, a small electric lamp of 6 volts is placed, the light from which traverses the instrument and serves for comparison. A circular field is examined—one half being illuminated by the electric lamp, and the other by the light of the body the temperature of which is being measured. By moving an eye-piece fitted with a nickle prism, the two halves of the field are brought to the same intensity. The angle of rotation is read off on a graduated circle, and a table, provided with each instrument, gives the temperature calculated from the above law. In short, the process consists in measuring an unknown temperature by comparing it with rays of known temperature emitted by the electric lamp. The operation is so simple that any intelligent workman can be trusted to take exact readings after a little practice. The apparatus is only about 30 centimetres (12 inches) in length, and is handled like an ordinary small telescope. The distance at which the measurement is made is of no importance. It is only necessary that the total field shall be illuminated by the source of heat. The small electric lamp has to be adjusted to a constant temperature. Unless this is done, variations in the electro-motive force of the accumulators and the decrease in the intensity of the lamp may give rise to considerable errors. Accompanying each instrument is a check apparatus, with which these sources of error can be removed.

The law of Wien and Planck, to which reference was made above, was worked out in theory by them, and confirmed by experiment for temperatures up to 2300° by Lummer and Pringsheim, of the Physico-Technical Institute of Charlottenburg. The result of their researches was given in the article which appeared in the "JOURNAL" for the 9th of May last, already mentioned. According to Kirchoff, a theoretically dark body consists of an empty space surrounded on all sides by walls impenetrable to heat and perfectly reflecting. In place of reflecting surfaces, it is possible to imagine others which would remain at the same temperature as that of the space between them, reflecting the same quantity of heat as they receive from the interior. If a small aperture were made in the wall, the radiation would not be appreciably altered, nor would the black space. All closed furnaces, obviously answer to these theoretical conditions. Inasmuch as, for well-known reasons, the walls possess the maximum impenetrability to heat, the second condition—the equality of temperature between the walls and the space enclosed—is fulfilled. It is likewise evident that in all cases of incandescent bodies, solid or in a state of fusion, the above law holds good; all the more so since with increase of temperature the difference in the dark body decreases in increasing ratio and finally becomes negligible.

Thus it can be admitted theoretically that the temperature of incandescent bodies, either solid or liquid, can be determined by the intensity of the rays of a narrow band of the spectrum. The determination of the temperature of flames cannot be made with this pyrometer; the radiation of the flame being so different from

that of a dark body that Wien's law does not hold good. Nevertheless, it is possible to determine the temperature of the flames of the Bessemer converter by the radiation of the gas emitted. As the apparatus gives exactly only the temperature of dark bodies, it is necessary, in comparing it with a Le Chatelier pyrometer, to measure the same temperature with the two instruments. There is a difficulty in doing this, as the temperature recorded by the thermo-electric pyrometer is that of a given part of the space, not that of the space itself.

The construction of the optical part of the photometer will be understood from the illustrations accompanying Mr. Bond's paper. M. Parsy gave full details as to the manipulation of the instrument; but a translation of these would be of interest only to those who have instruments at their disposal.

AUTOMATICALLY LIGHTING AND EXTINGUISHING GAS-BURNERS.

At the recent Congress of the Société Technique, a paper on this subject was submitted by MM. Bigeard and Maggioni, in which they gave the results of trials made at the Angers Gas-Works of practically all the systems of automatically lighting and extinguishing gas now in the market. In a few introductory remarks, they referred to the paper read by M. Lecomte at the Toulon Congress two years ago on the Canioni self-lighter, which was described and illustrated in the "JOURNAL" for May 26, 1903, and then proceeded to indicate the features of the various appliances to which they desired to direct the attention of their colleagues.

"*Fumivore*" *Lighter.*—This is an igniter composed of platinum black and very fine platinum wires, which is attached to the glass chimney by means of a small framework of aluminium. The pastille which carries the black is fixed to a very light crutch, mounted on a so-called *fumivore*, or smoke-consumer, of mica, which is balanced against an aluminium counterpoise. When the lamp is lighted, the warm current of air produced raises the mica plate, and thus puts the platinum out of its reach, and preserves it for a much longer time. On the lamp being extinguished, the mica plate, with its crutch, falls by its own weight on to the upper part of the chimney, and then the pastille is ready for further action. Human agency is necessary for the lighting and extinguishing operations. In this apparatus, the spongy platinum, though protected from heat, is exposed to accidental shocks. Dust can settle in it, and the deterioration which it thus experiences renders it useless after some time. Occasionally the burners light-back. The system cannot therefore be recommended for lighting distant burners, nor for the public lamps, and it is only suitable for incandescent burners with a chimney.

Konus Lighter.—This apparatus is devised on the same principle as the preceding. Spongy platinum with platinum wires is suspended in the middle of a cylindrical pointed helix of white metal wire. It is more perfectly protected against vibration, but is always exposed to heat. According to our experience, the lighter has an average life of only three or four months, even when care is taken to clean the pastille every month in the direct flame of the bunsen burner.*

Besnard Lighter.—This appliance has a flash-light which is always burning. A sudden difference of pressure of one or two tenths (unnoticed by consumers) causes a light bell, floating in a cylinder fitted with glycerine, to rise or fall. The bell thus opens or closes a valve which admits or intercepts the discharge of the gas about to ignite on coming in contact with their flash-light. The latter lengthens a little on change of pressure, or it may be extinguished. The weight of the bell is adjusted from the outside with shot. The apparatus is suited for public lamps in small towns where the pressure during the day is lower than the minimum to which it will sink during the entire period of lighting. It could thus be utilized in more important towns for the districts which are under uniform pressure.

Automatic Extinguisher.—When the lamplighter desires to reach the burner, he can only open the tap by moving, through an arc previously fixed and regulated, a bronze sector, which by its rotatory movement actuates clockwork mechanism that runs down gradually and allows the passage of gas. When it has completely run down—that is to say, at the moment previously fixed—the sector suddenly falls and closes the tap. This apparatus, which acts only as an extinguisher, is rather bulky; and at the moment fixed for extinction, it sometimes happens that the sector, instead of falling completely to close the tap, stops half way, and the flame is not put out. It can be adapted to either enclosed or open-flame burners.

Automatic Igniter and Extinguisher with Clockwork Mechanism.—This appliance carries one or two flash-lights which are always burning; and it remains in action for eight days. A dial-plate, divided into 24 hours, is set to the hour at which the lighting is required. The needle or needles (according as the apparatus serves one or two burners in the same lantern), indicating the hour of extinction, are likewise put in position—usually one about midnight, and the other at the hour fixed by the regulations of public lighting. At the hour decided upon, a toothed wheel gears with a pawl which liberates a spring that acts suddenly on a valve and allows the gas to pass. At the hour fixed for extinction, actuated as before by the toothed wheel, the valve suddenly closes and cuts off the gas. The appliance is somewhat heavy and bulky; and the mechanism, though well made, soon deteriorates, but works with remarkable exactness.

Pole Lighter.—The principle of this lighter is based on an electric magnet, which by completing a circuit acts on a hammer. The latter by means of a small eccentric opens the tap, and at the same time a spark passes across two conductors fixed at the proper height to ignite the gas. To extinguish the burner, the circuit is re-established, and the tap closes in the same manner that it was opened. The return current can be earthed. The device can be applied to all kinds of burners, but best to those of the incandescent type.

Téléphos Lighter.—The principle of this appliance is the same as that of the one just described, except that instead of acting on the seat of a tap, the hammer works on a lever, which in turn acts on a valve, opening and closing it alternately. At the same time, instead of producing a spark, the current raises to redness a platinum wire which lights a small jet of gas issuing from a pilot tube. The passage of the latter is controlled by the same hammer; so that when the current ceases the hammer falls, the burner remains lighted, and the flash-light is extinguished. This appliance is specially suitable for incandescent burners and private installations.

The Giorgi Lighter.—The drawback to the two immediately preceding appliances is that, when the meter is closed, the current is broken at the open position of the tap, or of the raised valve if an escape of gas occurs when the meter is opened. This is avoided by MM. Amedeo and Giorgio Giorgi, of Florence, who described before the Society an apparatus based on the same principle as that of the two just noticed. In closing the circuit, the hammer attracted by the electro-magnet displaces a steel bar which then opens a way for the gas. The latter is thus admitted into a small cylinder, and thence to the burner and to the flash-light, which works on the following principle: The platinum wire, offering strong resistance to the current, is raised to about 300°, and heats the spongy platinum, which thus absorbs gas more rapidly. On breaking the circuit, the hammer falls, the bar closes the passage to the flash-light (which is thus extinguished), while leaving open that to the burner. A second passage of the current brings back the hammer, which strikes the bar controlling the gas supply, and both burner-jet and flash-light are extinguished. But the circuit does not go directly from the battery to the lamp and thence to the interrupter on its way back to the battery. It passes over the tap of the meter by means of an ebonite tube containing a little mercury; the tube being in one piece with the tap. The current can pass only when the meter is open, and is cut off when it is closed. All danger of accident is thus avoided, because if the burners are at the open position with the meter closed, the gas cannot pass. On the meter being opened, as soon as the gas flows, the circuit is made and the burners ignite. This system is useful either for private lighting by passing the line over the meter, or for limited installations of public lighting by controlling each section from the works. Examples are given of some small towns in Italy where the current was obtained by means of special connections with the telephone system.

Pneumatic Lighter.—This appliance carries a permanent flash-light. The passage of the gas to the burner is controlled by a bronze piston which moves in a small horizontal cylinder. The piston has a groove parallel to its direction of movement. If the groove coincides with the gas inlet, and therefore with that of the burner, the gas passes and ignites the flash-light; otherwise it does not pass. The piston moves in two directions in its cylinder by the pressure or exhaustion of air, which is brought about by means of a button acting on a wooden piston which moves with but little friction in its cylinder, and thus produces either pressure or vacuum. By means of a perfectly sound tube, provided with an elbow joint, the pressure or the vacuum is transmitted from the wooden to the bronze piston. One button suffices to control as many as four lamps. A burner can also be worked by several buttons, so that the installation is highly adaptable. The buttons and burners can act at a distance of as much as 25 to 30 feet. The lighter is convenient and of a size which makes it specially suitable for indoor work.

To recapitulate, in view of the experiments made at Angers, we can come to the conclusion that up to the present the automatic lighting appliances in which spongy platinum is used are those which have met with the greatest favour. Obviously, much care and supervision are necessary; but the employment of an additional flame is avoided for a certain time. The obstacles to the use of these lighters, apart from natural wear and tear, are dust and damp. M. Besnard's appliance, working by pressure, is specially applicable to the public lighting of small districts, or of certain sections where equal pressure is maintained in small towns. The necessity for having a flash-light on each burner is, however, a drawback. We did not test at Angers the clockwork igniter described under the fifth heading; but we hear satisfactory reports of it. The pole cylinder, mentioned in the succeeding paragraph, has been little used in the town. With regard to the "Téléphos" lighter, it has been used for two years in a room. Its action appears to be somewhat complicated. It acts fairly

* This lighter was shown at the Earl's Court Exhibition.—ED. J.G.L.

well when installed on double separated burners—say, a two-branched chandelier. It is somewhat delicate; but no doubt it can be improved. The appliance of MM. Giorgi has been described from a drawing; but it is reported to us as being a very practical one. The device which has given us most satisfaction is the pneumatic lighter, which has been in use for upwards of two years in several indoor installations. It acts best when used on a single burner; on two or more it has not given us such perfect results. It requires a permanent flash-light; and on that score is inconvenient, as the light needs attention.

In conclusion, while acknowledging that the appliances we have described are calculated to render great service to our industry, seeing that several of them are in demand by consumers, we may nevertheless express a hope that investigators will eventually succeed in discovering a method of instantaneous lighting more certain, more practical, and more economical than the majority of those we have been considering.

THE GROWTH OF LARGE GAS-ENGINES ON THE CONTINENT.

By M. Rodolphe E. Mathot, of Brussels.

[Extracts from a Paper read at the Liége Meeting of the Institution of Mechanical Engineers.]

So long as town gas was the fuel *par excellence* for industrial engines, by reason of the facility attending its use, the applications of the explosion engine were limited to 50 to 75 horse power, beyond which the cost of working was found to be excessive. Poor gas, produced under pressure with the old apparatus of the Dowson type, enabled one, it is true, to venture upon 75 to 100 horse power, and even greater powers, with more practical results; but the complication of the gas-generating apparatus, the initial cost, and the space taken up by the producer plant and engine rarely compared favourably with the steam-engine and boiler. The latter, moreover, adapts itself better to every class of fuel, whether gaseous, liquid, or solid. Among solid fuels, coal dust, as also peat, vegetable waste, straw, and sawdust constitute very advantageous fuels without requiring complicated and troublesome furnaces.

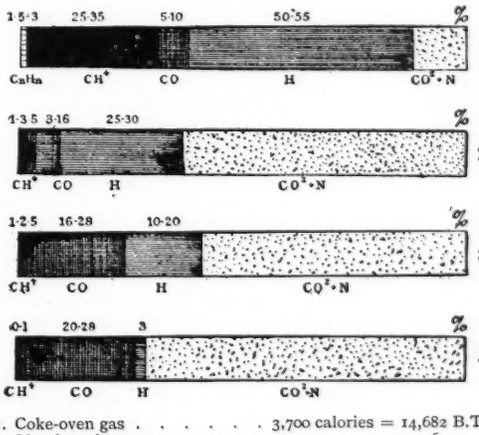
In order to compete successfully with the steam-engine, the explosion motor required to be provided with cheap gas, easy of production by means of simple and economical apparatus. Suction gas-producers have decided the question for the industry in general; while the purifying and washing processes for blast-furnace gas, coke-oven gas, &c., have, in an unexpected manner, brought about the possibility of applying explosion engines to the greatest motive powers required in the metallurgical industry. While in electric lighting stations the steam-engine, in spite of its great regularity in work, encountered a serious rival in the gas-engine, the petrol-engine has decided the question of road locomotion.

The development of large gas-engines can be said not to date back further than five to six years. Eight to ten years ago they were initiated simultaneously in Germany, England, and Belgium; early attempts being made to utilize blast-furnace gas, which was expected to open up such a vast field for the employment of large engines. Although the first trials were only attempted on small ones, the results of the experiments soon gave encouragement to the efforts of the investigators. The Cockerill Company, of Belgium, constructed a single-acting Otto-cycle engine of 200-horse power, which has been working regularly at their establishment for six years. This stage in the path of progress was strongly accentuated by the 600-horse power engine, on the Delamare-Deboutteville system, which the Company exhibited at the Paris Exhibition in 1900. This magnificent engine was single-acting; the piston having a diameter of 4 ft. 3 in. and a stroke of 4 ft. $7\frac{1}{8}$ in. It was designed to develop its power at 80 revolutions per minute, which, with an initial explosive pressure of 310 lbs. to 325 lbs. per square inch, produced on the piston a pressure of 300 tons at each explosion. In a short time several famous firms started, in their turn, upon the construction of large engines intended to utilize the gases liberated by the various reactions occurring in the manufacture of iron, coke, &c.; and the metallurgical industry was not long in entering upon the path of progress by replacing for its old boilers and engines powerful installations of explosion engines. It remained, however, to conquer the vast domain of manufacturing industry. It is in this sphere that the struggle is taking place with the steam-engine, which a long career has endowed with improvements in methods and execution. Though the generic theory of gas-engines has rested up to the present on a series of hypotheses which have not yet received experimental confirmation, these engines have gained ground in application to various industries with exceptional rapidity compared with any other kind of motive power. The invention of gas-producers and improvements made the last few years, and especially in those working with direct suction of the engines, are manifestly most important factors in this success.

Before examining the successive developments of these producers, the principal phases of the improvements through which the engines themselves have passed will be analyzed. It was first of all in Germany, and then in England, that their construction underwent the most rapid development. Afterwards America was the country which produced the greatest number. It is therefore not surprising to notice that each type has retained, in its construction or design, something which, as a birth-mark, reveals its nationality. The German engine has always presented the appearance of a well-finished machine as regards constructional details—all the parts machined were usually polished bright, which disclosed a real anxiety on the part of the makers to impart a high finish to their machines. This, of course, affected the price; but the life of the engine was materially increased thereby. There are cited as examples of longevity certain "rack" engines of the Otto-Langen type and make, which are completing a career of thirty years' service. The English makers took up another position—viz., that of producing cheaply in order to secure a large sale. Thus we are indebted to them to a great extent for the propagation of small engines for industrial purposes. English engines, designed for the use of town gas, vie with each other in ingenuity in the arrangement of their parts in order to attain efficient and simple mechanical devices.

But the merit of having entered upon the new path which the construction of gas-engines has followed for five or six years undoubtedly belongs to the Germans. The old makers of gas-engines in Germany took the initiative of departing from old methods. In a short time their processes were themselves improved and perfected by the makers of steam-engines, long accustomed to circumvent or overcome practical difficulties in the construction of large engines. With large gas-engines gravitating towards a single type, it may be said that they all have manifest tendencies to resemble the modern steam-engine from the point of view of their form and valve gear. Having regard to the fact that valves are the common means of distribution, that they are operated by a side shaft, and that large engines now work double-acting, it was natural and logical that the explosion machine should borrow from the steam-engine the design and methods with which it has been equipped in its long and victorious career. The introduction and growth of suction gas-producers and the utilization of blast-furnace gas, coke-oven gas, &c., which have marked the development of large gas-engines, have led to the creation of different designs for their construction. Different principles have thus been modified in their applications, such as the regulation, the compression, the cooling, and the ignition.

Without dwelling upon the different stages of their transformation, the author proceeded to show in what way modern methods differ from old ones, and the probable direction of future change, having regard to the knowledge and practical experience already acquired. He pointed out that modern large engines have attained high organic efficiency owing to the proportional reduction of their weight and the finish of their construction. Double-acting engines are usually made with a weight of at least 220 lbs. per horse power. It is generally admitted that Otto-cycle double-acting engines attain 90 to 92 per cent. of mechanical efficiency, whereas an output of only 75 to 80 per cent. was attained by two-cycle engines. This waste, being due to the work absorbed by the air-pump and by the gas-pump, cannot, however, the author said, deteriorate the value of the magnificent engines of which the Oechelhaeuser and the Körting are classical types, possessing their own advantages. Double-acting Otto-cycle engines attain a thermal efficiency of 28 to 30 per cent. relatively to the effective work—*i.e.*, a horse-power-hour is obtained with about 2200 calories (8729 B.T.U.). This consumption converted into the volume of the different gases used industrially would be as follows: Coke-oven gas, 585 litres (20·7 cubic feet); Mond producer gas, 1760 litres (62·2 cubic feet); anthracite producer gas, 1850 litres (65·4 cubic feet); and blast-furnace gas, 2500 litres (88·3 cubic feet). This implies the mean chemical compositions and the average calorific values indicated on the accompanying diagram, which shows the normal content of each gas in hydrocarbons (C_nH_n), marsh gas (CH_4), carbon monoxide (CO), hydrogen (H), carbonic acid (CO_2) and nitrogen (N).



1. Coke-oven gas	3,700 calories	=	14,682 B.T.U.
2. Mond producer gas	1,250 ,,	=	4,960 ,,
3. Anthracite producer gas . . .	1,200 ,,	=	4,761 ,,
4. Blast-furnace gas	900 ,,	=	3,571 ,,

The author then passed on to examine in their main features the improvements in the construction of large engines during the last three or four years. In order to proceed chronologically, he analyzed simultaneously the present engines of the Oechelhaeuser and Körting two-cycle type, and the double-acting Otto-cycle engines of the Deutz, Cockerill, Nürnberg, &c., types. Among the numerous gas-engines designed for the utilization of the waste gases of blast-furnaces and producer gas, he mentioned the remarkable two-cycle engines designed by Herr von Oechelhaeuser, which was one of the first to be applied in the production of high power. His system was put into practice in the shape of a 600-horse power engine in the early part of 1898, and on that occasion it disclosed its excellent qualities, which have continued throughout a period of seven years' work. The main feature of the system consists in the employment of two trunk pistons working in a single cylinder. The front one is attached by a connecting-rod to the centre crank of a triple crank-shaft, and works by thrust at the time of the working explosion; while the back piston is attached by a system of swing-bar and counter-rods to the side cranks, and works by pulling at the time of the explosion. The first advantage of this arrangement is the attainment of perfect balancing of the working parts, and more particularly of the crank-shaft, with regard to which the driving efforts neutralize the reactions at the bearings. The explosion chamber is formed by the cylinder itself and the ends of the pistons when the latter approach each other at the time of the ignition of the gaseous mixture. The explosion chamber thus forms a chamber presenting the minimum of surface cooled by water circulation, and free from passages and recesses which on ignition of the explosive mixture impede the movement of the pistons. These devices should have a manifest influence on the thermal output of the engine. The distribution is secured by the pistons themselves forming slide-valves, which uncover and in their movement again cover the ports provided in the cylinder for the admission of air and gas and the discharge of the products of combustion. About 60 of these engines, representing a total of 50,300-horse power, have found their way into different countries, particularly for use in metallurgical establishments.

Messrs. Körting Bros., of Hanover, have made gas-engines since 1881, and producers since 1889. Up to 1896, the firm had turned out about 3500 engines, representing 15,000-horse power. Since that time the Körting works have produced 7200 new gas-engines. In recent years in particular 50,000-horse power in two-cycle engines of their special type have been supplied. Side by side with these engines, the construction of the four-cycle type has developed, and the sale has attained 100,000-horse power; while at the present time engines are in progress representing several thousands of horse power. The Körting Company make Otto-cycle engines of the single-acting type in some 15 sizes, from 10 to 175 horse power; the latter type having a diameter of 630 mm. (24·8 inches), with a piston stroke of 1020 mm. (40·16 inches), and performing 135 revolutions per minute. The Company make a 200-horse power engine on the same system, but with two twin cylinders, 490 mm. (19·29 inches) in diameter and 800 mm. (31·5 inches) stroke, running at 160 revolutions per minute. These dimensions are amply large, inasmuch as they effect the work specified with a mean pressure of 65·4 to 66·8 lbs. per square inch on the piston, even if a mechanical efficiency of 80 per cent. only is considered. Single-acting Körting engines usually exceed this output. Above 250-horse power, the Company apply their double-acting two-cycle type of engine, which is used with producer, blast-furnace, and coke-oven gas.

As far back as 1894, the Cockerill Company made their first experiments on a small engine driven by gas from their blast-furnaces. Four years later the firm constructed, from the details furnished by the late Delamare-Debouteville, the 200-horse power engine which is still driving an alternating current dynamo for the production of motive power. Then came the famous single-acting engine of 600-horse power which drives a blowing apparatus for the blast-furnaces, delivering 500 cubic metres (17,658 cubic feet) of air at a pressure of $15\frac{3}{4}$ inches. This engine, started in 1900, formed the subject of some memorable experiments undertaken under the direction of Professor Hubert, with the collaboration of a few experts, such as Aimé Witz and the late Bryan Donkin. In order to increase the power of the engines without adding to the dimensions already involved by a piston 51 inches in diameter and $55\frac{1}{4}$ inches stroke, the technical department of the Company designed one with tandem cylinders, which enabled the power to be doubled while increasing the regularity. The Company were one of the first to take up the construction of double-acting engines, which has since become common; and these have gradually replaced the single-acting type, which are now supplied in exceptional cases only. The types of engines constructed by the Company are divided into single-cylinder engines, those with two twin cylinders, engines with two cylinders in tandem, and four-cylinder twin tandem engines. The double-acting single-cylinder engines are made up to 1500-horse power. With their four-cylinder double-acting twin tandem engine, the Company can obtain a prime mover of 5000 to 6000 horse power. The total number of engines constructed by the Company and their concessionaries has reached 148, representing 102,925-horse power, or an average of about 695-horse power per engine. The purposes for which they are employed are approximately the following: Generation of electricity, 45 per cent.; blast-furnace blowers, 52 per cent.; rolling mills, 2 per cent.; miscellaneous, 1 per cent.

The brilliant record of the gas-engine works at Deutz is well known. Continuing the traditions of their illustrious founders—Messrs. Otto and Langen—they have for forty years constructed the four-cycle engines bearing the name of the inventor. Since their formation, the Company have turned out nearly 70,000 engines. They necessarily commenced with the small single-cylinder horizontal and vertical engines; since 1895 they have been engaged in the construction of high-power blast-furnace single-acting engines, attaining with one, two, and four cylinders, twin or double-twin, powers of 125, 500, 1000 horse and upwards. A large number of these engines were in a short time working in industrial establishments with generator, blast-furnace, or coke-oven gas; while others took the place of steam-engines in water-works and electricity stations for towns, &c. One of their 1000 to 1200 horse power engines with four cylinders twin and opposite, installed at the Hörder Bergwerk Works at Horde, Germany, has been referred to in the "Journal." This engine is combined with a fly-wheel dynamo, and works with blast-furnace gas. The 1200-horse power four-cylinder engine exhibited at Düsseldorf in 1902 won the admiration of experts as being a type of the most powerful engine of the time in Germany. It was constructed for driving a blast-furnace blower to furnish 35,000 cubic feet of air per hour at a pressure of about 7·4 lbs. These large engines, constructed according to the single-acting type, attained the excessive weight of 396 lbs. per horse power. Their price was necessarily high, and the space occupied excessive. It was therefore necessary to find a solution of this difficulty in order not to impede the development of large engines. Such a solution is found in the double-acting engine which is now the current type of the Deutz works. The author examined the characteristics of the small engines made by the firm, and concluded his remarks upon their productions by stating that the number of double-acting engines supplied by them or in course of execution amounts to 64, ranging in size from 200 to 2000-horse power, with an aggregate of 34,660-horse power.

With regard to other Continental firms making gas-engines, the author pointed out that the Nürnberg Company had always devoted themselves to the construction of high-power motors, and had won a well-earned reputation. The Company quickly discovered that the use of the single-acting engine, whose dimensions were being increased and cylinders multiplied in order to obtain sufficiently powerful engines for modern requirements, was only transitive; the space occupied, the enormous weight, and the low efficiency of these types of engines being defects causing them to be abandoned in favour of the double-acting type. Still, for small power, up to 175-horse, the Company make the single-acting engine, and even of double this power, if necessary, by using twin cylinders side by side. Among the largest engines made by the Company may be mentioned those of 3600-horse power twin tandem, forming part of a group of 9100-horse power of the Schalker-Gruben and Hüttenverein of Gelsenkirchen. Mention may also be made of the installation of 12,000-horse power in six units executed for the electric station of the Sociedad de Gasificacion Industrial of Madrid, which is driven, as also a 350-horse power engine, by fuel gas generated by Duft producers. From 1903 up to the end of November, 1904, the Company had supplied and had in hand 106 engines of their double-acting type, representing a total of 114,070-horse power. These engines are driven by blast-furnace, coke-oven, and producer gas, and are employed as follows: For the electrical service, continuous or alternating current, 79 engines, equivalent to 78,220-horse power; for blowing apparatus, blast-furnaces, steel-works, rolling-mills, and various applications, 27 engines, representing 35,850-horse power. The firm of Ehrhardt and Sehmer, of Saarbrucken (Alsace), have also won distinction for the construction of large engines, and have built in three years some fifteen engines, representing a total of 12,680-horse power, on their double-acting system, in which they also arrange the cylinders either twin or tandem. The engine made by the Dingler Engineering Company of Zweibrucken (Alsace) differs materially, from the point of view of the system, from the devices employed by other makers of large engines. Instead of obtaining the double action in a closed cylinder by exploding the mixture alternately on each face of the piston, two cylinders open at one end are united at their explosion chambers. Each of these cylinders contains a piston, the two being connected together by an internal rod. The explosion is therefore produced alternately on each inside face of the pistons. The system avoids the use of piston-rod stuffing-boxes, and lends itself to the free expansion of the jacket and inside cylinders—only solid at one end.

Before closing his paper on a new motive power which utilizes every kind of fuel gas produced commercially, the author thought it advisable to point out the principal difficulties remaining to be overcome in order to enable large engines working with poor gas in general to run with safety and with facility of control and upkeep—attributes which appear to have remained the special feature of the steam-engine. Economically, he said, the gas-engine is evidently superior; but low consumption is not the only quality which users require from a motive power. It is necessary above all that it should be free from the risk of sudden stoppages, which lead to expense, as they hamper production, and may at times be fatal in certain industries where breakdowns must be specially avoided. Such is the case with electric stations and with pumping, hoisting, and ventilating work in mines, &c.

The principal causes of breakdowns in engines fed by gas other than town gas, which undergoes complete purification, consists

in the fouling of parts—such as the pipes, the valves, and the cylinder—by impurities in the gas. In large installations, where it is extremely important to avoid breakdowns, recourse is had to special means of washing and purifying, by the use of centrifugal and other apparatus. But although these succeed in reducing to 0·2 gramme per cubic metre the amount of dust accompanying the gas, they still allow the passage of tar, which is the principal element destructive to the engine. It adheres to the sides of the passages, causes the valves and piston-rings to stick, and thus prevents their proper action. It also deposits itself in the cylinder, where it finally gives rise to premature ignitions. "It is this very question of tar which compels us," the author remarks, "in order to avoid great complications, to employ exclusively non-caking anthracite coal for the suction gas-producers now so largely in use owing to their simplicity and economical efficiency." The use of bituminous coal, especially in these producers, has not yet, he says, been industrially accomplished. But whether it is producer gas, blast-furnace gas, or coke-oven gas that is used, its purity is an important factor in the proper working of the engines it feeds. The organic defects of large engines do not appear to play in this respect a preponderating part. They should, however, be perfected as regards facility of access and upkeep of the parts, such as valves and piston. The oil consumption should be low, and they should be made less susceptible to variations in the quality of the gas. The author considers that the skill of experts and makers will soon overcome these difficulties; and large gas-engines will constitute "one of the most remarkable industrial victories of the age in which we live."

WATER SUPPLY BY METER.

Relationship between Capital, Working Expenses, and Revenue and Consumption of Water, Population Supplied, &c.

By GEORGE O. H. KLOPP, Assoc.M.Inst.C.E.

[Paper Read at the Annual Meeting of the British Association of Water-Works Engineers.]

The relationship between the capital, working expenses, revenue from water delivered, consumption of water, and population supplied, is not, and can never be, a fixed quantity, and must vary in each individual undertaking, although the principle involved in the determination of the relationship may be a constant.

The broad rule or constant governing every case may be determined in the form of an equation.

Let x = charge for water for domestic use.
y = charge for water for trade use.
a = capital, including all expense on capital account.
d = depreciation.
a^1 = interest and sinking fund.
b = working expenses, including all expenses on revenue account.
p = net profit on capital outlay.
p^1 = population supplied.
n = gross profit.

Then $x + y = a^1 + b + d + p$ (in any year or at any given time).

If x could be treated in the same way as y, one great difficulty in the management of water-works undertakings in the United Kingdom would be eliminated; but there appears to be a rooted objection in this country to the supply of water for domestic purposes in the same manner as other necessaries of life; and even supply for trade purposes is often treated arbitrarily.

The equation $x + y = a^1 + b + d + p$ appears a comparatively simple proposition in the case of a known value of a and of p^1; but obviously in the case of new works, a cannot be known until the works are completed, and p^1 can only be approximately fixed.

To take a case for the purpose of argument: Let a = £100,000 (first cost of a water-works). Then d = say, 5 per cent. per annum, or £5000 for the first year. a^1 = say, £5000 for thirty years. b = say, £5000 per annum.

Then $p = n - (d + a^1 + b)$ £15,000.
Now $n = x + y$
$\therefore x + y = p + (d + a^1 + b)$.
And, say, p = £5000.
$\therefore x + y$ or n = £20,000.

Supposing the total population supplied at once to be 20,000, and the consumption allowed for to be 30 gallons per head per day, or a total of 600,000 gallons per day, with an added 300,000 gallons per day for trade purposes, or a total of 900,000 gallons per 24 hours, and adding one-ninth of this amount for unavoidable waste, there is a total supply of 1,000,000 gallons a day to be dealt with. This 1,000,000 gallons per day costs £20,000 to handle, or 365,000,000 gallons cost, with 5 per cent. profit per annum, £20,000. Therefore 365,000,000 gallons cost £20,000 per annum; 365,000 gallons cost £20; 18,250 gallons cost £1; 1000 gallons cost, allowing for a net profit of £5000, about 1s. per 1000 gallons, allowing for the estimated loss of 100,000 gallons a day in waste.

We have, therefore, 109,500,000 gallons for trade (say) at 1s. 6d. average per 1000 gallons, and 219,000,000 gallons for domestic use.

$\therefore$ trade = £8212 10s.
$\therefore$ 20,000 domestic = £11,787 10s.

The present method of assessing domestic water supplies on the rateable value of houses is one which leads to all manner of difficulties, and is certainly inequitable in many instances. In fact, to be equitable under this system is obviously impossible. There is one method of overcoming the difficulty, and that is: (1) To allow a minimum per head of 30 gallons per diem (in this instance), and charge for this minimum (on a sliding-scale if necessary); (2) to charge a *pro ratâ* sum per 1000 gallons for any excess.

With the paper, the author gave two tables, showing the scale of water charges for trade and other purposes which come under the general heading of "trade supplies" in a number of towns. It is, he said, somewhat perplexing how such a diversity of charges can have been arrived at. That these bear any direct relationship to the cost of the water in any one of the towns appears to him somewhat doubtful. To quote one instance in the author's knowledge. A new water-works wished to fix its trade charges. Many towns were written to for information as to their trade charges. On receipt of the desired information, all charges were added together, and divided by the number of towns; and the resultant mean is now the charge adopted at the water-works in question.

Many water-works authorities have largely increased their income by a constant and systematic inspection of installations of baths, garden, amateur photographic supplies, &c., &c. All this detail work is necessary under present conditions, but unnecessary under the proposed system. Expense, trouble, and supervision of a hundred and one such details might, in the author's opinion, be avoided entirely by substituting a system of payment by quantity, with a stated minimum per head for domestic purposes.

Under existing conditions, only trade and mixed supplies can be treated in the manner the author advocates. If the two classes of supplies were so treated, matters would not be so involved; but there are grave reasons to fear that water-works authorities generally are not fully availing themselves of the powers granted to them.

Summary of the Discussion.

Mr. F. J. BANCROFT (Hull) thought the author could have stated his meaning with greater ease and clearness without the use of algebraical expressions. Mr. Klopp said that x = charge for water for domestic purposes; and y = charge for water for trade use. He presumed Mr. Klopp did not mean "charge," but revenue or receipts from domestic or trade use. In the preliminary statement, too, the author entered a charge for depreciation. He (Mr. Bancroft) would like to know if the author could give his authority for including this item as a proper charge in a water-works undertaking, either in the case of a company or municipality. In the case of a company, he thought Mr. Klopp would find that, in the absence of specific statutory power, a charge for depreciation was illegal; and in the case of a corporation, it was always contended in water-works construction that depreciation was covered by the sinking fund charge. Then they had the statement that $x + y = a^1 + b + d + p$. In the case of many municipalities p was frequently a *minus* quantity; but Mr. Klopp had apparently taken it as always being a *plus*. A little lower down, they had the expression $n = x + y$; or the gross profit equalled the domestic revenue *plus* the trade revenue. The gross profit, in his (Mr. Bancroft's) estimation, was the domestic revenue *plus* the trade revenue, *minus* the working expenses. They certainly could not take the profit before meeting the working expenses. Again, they had the expression $p = n - (d + a^1 + b)$. That was, the net profit equalled the gross profit *minus* depreciation, interest and sinking fund, and working expenses. He (Mr. Bancroft) thought net profit should be gross profit, *minus* interest and sinking fund; and this only obtained in the case of a corporation undertaking, and had no reference to a company who had no sinking fund charges. In the hypothetical case that Mr. Klopp had taken, he gave a million gallons as being allowed for a population of 20,000—that was, on an average of 50 gallons per head per day. The writer did not say whether this was the maximum or the average supply; but he evidently, from the way he used the figures, meant it for an average, seeing that he estimated 365 million gallons per annum. If this was so, to find the maximum supply, one would have to add about 20 per cent. more, which would equal 60 gallons per head per day. This consumption was very high and quite unnecessary for a well-managed concern; and, unless there were special conditions in the writer's mind, he did not think the figures were a fair basis upon which to work out any conclusions. Again, in connection with the succeeding figures, he considered there was a misuse of the word "cost." What he thought the author intended to convey was that the quantity of water mentioned must be sold at that price, which was quite a different thing from what it cost. Taking the "18,250 gallons, cost £1," he would alter that to "must be sold for £1." Then, if they took the writer's 10 per cent. for waste, they had only 16,425 gallons to sell for £1. Therefore, the price was 14·6d. Why the author took it at 1s., and why he dragged in a charge of 18d. for trade, he (Mr. Bancroft) did not in the least follow. If they were to have a mathematical treatment of this subject, then let them stick to mathematical figures, and divide the quantity into the price at which it should sell. The author took 109,500,000 gallons for trade, upon which he should add one-ninth for waste, according to his former estimation.

This at 14·6d. would be to a penny £6666, against the writer's £8212; and the domestic portion would be 219,000,000 at 14·6d., which would come to £13,334—making together £20,000. Why in this mathematical treatment of the subject the trade should be charged at 1s. 6d., and the domestic let off at a reduced figure, he did not see at present—that was, adopting the author's estimation that he could sell the same quantity of water for trade on every day in the year, Sundays included. But anyone having charge of a water undertaking with a trade supply knew he could not multiply the consumption of one day by 365, and base his estimates on selling the same quantity over every day in the year. Coming to the real subject of the paper—that was, the adoption of meters for domestic use—the author's suggestion appeared to be that they should allow a certain minimum per head per day. How the author was going to apply this to a number of houses, he did not know. He (Mr. Bancroft) thought it was quite impracticable. If a "little stranger" came to the house, the minimum charge would immediately go up. If a landlord took in lodgers, the minimum would go up; and when they left, the minimum would immediately go down. The minimum would be a fluctuating one; there would be nothing fixed at any one time in any one house. Take a meter supply in a case where the meter involved a capital cost of £5. The depreciation on the meter would be about 12s. a year; the standing charges on the reading of the meter, keeping the books relating to the meter supply, additional clerical work entailed beyond the consumer who paid upon his assessment, would be another 12s.; and keeping the meter in repair, 5 per cent. on the outlay, would be 5s. Therefore they had a total of £1 9s. upon the meter supply per annum to meet, and this was the minimum amount an authority must receive from a meter supply, in addition to the cost of the water, before any profit whatever could be made. How, then, was the writer going to deal with small property houses letting for 2s. 6d. to 3s. per week? The Local Government Board laid it down expressly in such cases, and they limited the local authorities' power to compel a water supply unless the cost would not exceed the rate authorized by the Water Act, or, where there was no Act, it must not exceed 2d. per week. How was this to pay the sinking fund and interest, and standing charges and depreciation on a meter supply, when he (Mr. Bancroft) had shown that a ½-inch supply would entail probably £1 9s. a year, without the cost of the water? Meter supplies in such cases were quite inadmissible. They would very much like to measure more water than they did; but he should like the author to enlighten him as to how they were to adopt a meter supply for small houses, the payments of which would be about 8s. 8d. a year each.

Mr. W. Matthews (Southampton) said the main point that had struck him was the impracticability of applying the conclusion the author had arrived at as to allowing a minimum of 30 gallons per day in lieu of the present method of assessment. They were prepared to admit that the present method of assessment was not all they could wish for; but he assumed also there was no subject which, in recent years, had engaged the more serious attention of water-works managers than the endeavour to arrive at something which should be as nearly equitable as the wit of man could devise in this respect. Taking Mr. Klopp's assumption that it could be done by arriving at some amount which was applicable per head of the population, they were immediately faced with this: Take a concrete example of two houses, one of which was rated at (say) £20 or less—he would say "less," so that it came under the rule of 2d. a week—and another of a high rateable value. The probabilities were that into this small house would be crowded the average population of the town—say, five or six persons. In the other house, inhabited by people of the more wealthy class, and of perhaps a rateable value of anything from £80 to £100 or £150 a year, they would find the same number of people, or perhaps even less, or including servants no larger population than would be found in the case of the small house. Multiplying the 2d. per week paid by the small house by 52, made 104d. Now if they supplied these people by measure, and took Mr. Klopp's figure of 30 gallons per head, what did it mean? It meant that, charging for the water by quantity, and only charging 1d. per 1000 gallons, they would be getting 2s. 9d., instead of 1s. 8d. Was there any possibility of inducing the Legislature to so alter things that the labouring class property in this country was going to have its water-rate raised from 1s. 8d. to 2s. 9d? He said undoubtedly that it was absolutely impossible, and that to argue upon these lines, and to endeavour to suggest by the paper that anything of the kind was possible, was pure waste of time. To suggest such a thing as the metering of supplies by those who were connected with corporations who were responsible for the health of this country—to suggest such a thing as the limiting of the quantity of water—would be absolutely futile. There was no chance of passing such a scheme. As opposed to that, it was suggested they should have a minimum; that everybody should be compelled to pay for a quantity of water just enough to keep him clean. The mean man, in his anxiety not to overstep the limit, would go dirty. He was aware the meter system had been tried in Abingdon and somewhere else. In little places like that it might, with a large amount of supervision, be made to answer. But did they think that in places like Birmingham, Leeds, and Bradford, with their big working-class populations, such a system could be made to work?

Mr. C. E. Jones (Leyton) thought that, in the discussion, they had somewhat departed from the principle upon which water charges were founded in this country. The Legislature did not impose a charge for water at all; it imposed a charge for the conveyance of it, which was a totally different thing. And, furthermore, in order that the poor man should be as well off as the rich in his water supply, they took the poor-rate assessment; and upon that assessment for the time being a water valuation was made, upon which the unfortunate landlord or occupier had to pay whether he liked it or not. Efforts had been made from time to time to find a more reliable source of assessment; but up to the present such attempts had not been successful. The author's idea in the paper appeared to him (Mr. Jones) to be a perfectly sound, theoretical one. There was a principle in common law that a man should not pay for a thing he did not have. He (the speaker) did this every day. He paid for water that he never had, and so did every other householder or landlord of property; the property had to bear a charge irrespective of the amount consumed. If they bore this in mind, that water was not charged for at all but only the conveyance, it would be seen that Mr. Klopp had missed the main point in his paper. It stood to reason, if they were going to buy water on the same basis as milk, they would find the economical man would try to do with as little as possible. He would, however, say this for the author, that if water could be sold by measure, it would be far more equitable than the present rate of assessment; but the question of sanitation came in, and that would always militate against the selling of water by measure for domestic purposes. There were many instances in which water companies and municipal authorities did not avail themselves of their full powers. In his own experience, he had cases in which he had put on experimental apparatus in order to ascertain what had been used for trade. For the water for which he was charging 5s. or 10s. a year, he had found in some instances that, if he had charged on the principle of conveyance, there would have been a difference of charge amounting to no less than 500 per cent.

Mr. George Hodson (Loughborough) said the supplying of meters to every service would be a very expensive business. It would add at least 50 per cent. to the expense of gravitation water-works, which would be a very serious matter. Instead of the money going to the interest and sinking fund, it would be going to the meter manufacturers. It was an unnecessary thing to do. He need not point out to those present, too, that they had not yet a reliable water-meter which could be obtained at a low cost. One of the big bugbears of the water-works manager—especially when selling water between two authorities—was the constant squabbles and troubles as to meter indications. He had been looking forward to getting a satisfactory water-meter for the last thirty years; and there was not yet a single one on the market on which he could place absolute reliance. Looking at the whole subject, water-rates as they were levied now under the various Acts of Parliament was the fairest way of charging that he could conceive. When the question of 2d. per week was spoken of as being the maximum, that was only the case where a local authority compelled a supply to be taken. There were, however, instances where the Local Government Board sanctioned higher rates, where it was proved to be impossible to supply water at 2d. per week, and they had allowed 3d. and 4d.

Mr. H. Preston (Grantham) called attention to the author's remark that "if the charge for water for domestic purposes could be treated in the same way as the charge for water for trade use, one great difficulty in the management of water-works undertakings in the United Kingdom would be eliminated." He (Mr. Preston) would like to know what that one great difficulty was? Was it how to apportion the rate they made for the water supply so that they should pay a fair interest on the capital outlay? Of course, theoretically it would do that, and they would like to adopt it; but, in practice, the difficulties would be quite equal, and quite as great as at the present time. They knew, for instance, companies who now paid perhaps 1, 1½, or 2 per cent., who, by the adoption of meters, providing they were managed fairly at the present moment, would not be able to raise the income so that 5 per cent. could be paid. Again, the difficulty might be among those items which the author gave in the latter part of the paper, when he said: "Many water-works authorities had largely increased their income by a constant and systematic inspection of installations of baths, gardens, amateur photographic supplies, &c. All this detail work is necessary under present conditions, but unnecessary under the proposed system." He (Mr. Preston) did not think that was correct. The remedy was quite as bad as the disease, because they had all known, he believed, of pipes which had been misplaced in houses; and that, when the main was being turned off, there was great risk of impure gases and other substances being drawn by back-draught into the mains. When a water-meter was put in, they generally supposed the consumer would be his own inspector. Their own inspectors did not go beyond the meter as a rule; and consequently, unless they had an efficient back-pressure valve between the meter and the main, the risk was considerably greater than it was at present without the meter. The intelligent inspector knew what he had to look for. He would trace every service, and see every tap. Anything that was wrong, or would cause danger, he would report, and would have it altered; whereas if meters were universally adopted, this would not be the case. Their risks would be increased; so that, on this ground, the argument did not stand. Every service, or part of a service, should be efficiently inspected whether the supply was metered or not.

Mr. J. S. Pickering (Cheltenham) expressed his unqualified

disapproval of any suggestion to supply water for domestic purposes by meter; and he really did not think that any such suggestion was worthy of the serious consideration of the Association. As one speaker pointed out, in the case of cottage property, the hire of the meter, taken at a fair percentage, would be considerably more than the cost of the water; but of primary importance was the consideration of health. However desirous they might be to curtail waste, the matter ought to have consideration first from the sanitary point of view. He agreed with Mr. Hodson that there was no such thing as a reliable meter on the market. The author had suggested a minimum supply of 30 gallons per head per day; the President in his address had stated that this was too high a minimum. Twenty gallons was all that was necessary; and this could be brought about by better means than the provision of meters for domestic supply. It must always be recognized that the wealthy must contribute to the welfare of the poorer class. The present system he thought was infinitely better than the adoption of the meter supply.

Mr. F. Griffith (Leicester) said he had had in his own case to take the capital of the undertaking, and the interest and the sinking fund, and to find the cost of water, with the view of fixing a scale of charges for meter supplies, after deducting the revenue received for domestic purposes, so that they might receive a reasonable profit for the water supplied in bulk. So far as this method of supply was concerned, he thought the suggestions submitted by the author in his paper were very reasonable and fair. Some of the speakers, he fancied, had lost sight of the fixing of the basis of charge for water supplied by meter for trade purposes irrespective of the question of the water supplied by rate for domestic purposes. The rating of water for domestic or trade purposes was a very large subject, and it could not be dealt with in papers, and especially before a body of gentlemen like themselves, where they perhaps had all different views, different classes of people, and different systems to deal with. They must suit themselves to the occasion, as what would be binding in one place would be totally inoperative and misleading in another case. As to the reliability of meters, in his own case, they had five different classes of meters, and there was not one of them perfect.

Mr. Easton Devonshire (London) said they all knew there were more bad than good meters. But he did not admit that there were not good positive meters, and that it was impossible or impracticable to use a meter for domestic supply which would give a fair average, and within 5 per cent. of the water really consumed. It was true such a meter was an expensive one. His experience, of course, was in foreign places where meters were used exclusively. Referring to Brussels, he pointed out that there one could not find out what the profits were. No account was taken for capital, sinking fund, and so on. But there the rich man paid a high proportion. If the rich man added to the actual cost of the water at (say) so much per 1000 gallons the increased rate he was called upon to pay to meet capital expenditure, it would be found that it came out much the same as where a man was taxed directly and much more fully on the rental value of his house. It was said that the rich men paid for the poor. They did not altogether do that; they paid for the health of the poor, which was paying for their own benefit.

Alderman Bloor (Birkenhead) pointed out that, with regard to Birkenhead, they were able in the Water Department to cover all charges, and to hand over a somewhat considerable sum to the relief of the rates. In his opinion, under the meter system, water undertakings would derive from the houses of the rich less than they did at the present time. The rich consumer would be largely benefited; whereas the poor, if they at all exceeded the minimum proposed, would be charged more than they were now.

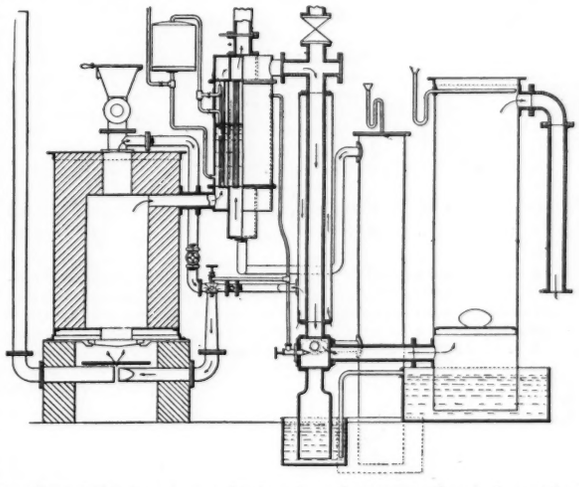
Mr. Klopp, in reply, said he was afraid it would be impossible for him to answer the discussion in detail; and therefore he would go over the remarks in a general way. It appeared to him that he must have been very obscure in the wording of his paper, because all the speakers seemed to take it for granted that he suggested, or would advocate, the charge for water per quantity to everybody. He distinctly stated that his proposal was: First, to allow a minimum per head of 30 gallons per diem, and charge for this minimum (on a sliding-scale if necessary). Secondly, to charge a *pro ratâ* sum per 1000 gallons for any excess. This was simply an instance given as a sort of general argument. He did not say that 30 gallons was too little or too much; and then he said "charge for this minimum on a sliding-scale if necessary." What he meant by a sliding-scale was that they could charge the rich man more than the poor man. They could arrange to charge on the rateable value if they liked—that was to say, a man who was paying £20 a year for his house could pay the same amount that he was being charged now; and he would get the same water for all purposes as the man who was paying more for his bigger house. He failed to see how the poor would be affected in that instance. Mr. Hodson had said that he did not think there would be any saving, or rather that there would be a far greater expense, in adopting the meter system than under the present system. For this country, unfortunately, no data could be given, because the meter system had not been tried. But in the United States there had been a considerable amount of experience; and the published figures went to prove conclusively that meters were useful in stopping waste. He thought the paper had been somewhat misjudged, because he did not intend to suggest a mere payment by quantity, which would fall very hardly on the working classes. In the last paragraph of the paper, he stated most distinctly: "Under existing conditions, only trade and mixed supplies can be treated in the manner advocated. If the two classes of supplies were so treated, matters would not be so involved; but there are grave reasons to fear that water-works authorities generally are not fully availing themselves of the powers granted to them." He was quite aware the question of meter supplies at present, and for some years to come, would be "in the air." Certainly, it might never come. But he thought that a study of the meter question in the United States would show that the adoption of the meter system throughout did not cost more than the present system of *laisser faire* and waste.

REGISTER OF PATENTS.

Suction Gas-Producer Plant.—Whitfield, C., of Kettering. No. 9608; April 27, 1904.

In this "suction gas-producer plant," the generator is open to the atmosphere; and the gas as it is produced, and after it is cooled and passed through a scrubber, is drawn directly into the cylinder of a gas-engine by the charging stroke of the piston. In existing plants, the patentee points out, a large part of the effective action of the piston on the gas is lost owing to the tendency of the gas to expand or become rarefied on being drawn into the engine cylinder; consequently the compression of the combustible mixture is not so high, nor is the efficiency of the engine so great, as when the gas is supplied under pressure. A further drawback is that with the air in the ash pit of the generator acted on by the displacement of the piston, it tends to create an irregular flow of gas or air through the generator, which is not conducive to the production of good gas.

One object of the present invention (a cross section of the plant is shown) is to produce in this type of plant a set of conditions conforming closely to those obtaining in plants of the pressure type—that is, to provide means in or about the plant whereby the gas responds more easily to the charging stroke of the piston, and at the same time in no way detrimentally affects the flow of the gas (or air) through the generator.



Another object is so to supply the air and steam to the producer that only the amount necessary for the production of the gas for the time being goes into the producer; the surplus passing freely into the atmosphere. A further object is to utilize the heat of the gas as it leaves the producer for generating the requisite steam for working the generator.

According to the first part of the invention, between the gas producer or generator and the gas-engine to be supplied with gas one, two, or more water seals are introduced—open to the atmosphere at one part and to the interior of the chamber or chambers through which the gas flows to the engine cylinder at another part. They are so arranged and proportioned that, on the withdrawal of a volume of gas by the piston of the engine, the water rises in the chamber or chambers to an extent approximating to the volume of gas withdrawn, and thereby allows for the withdrawal of the gas without its being rarefied as much as in the old plant, and without the withdrawal materially affecting the flow of the gas in the producer. Owing to the producer being open to the atmosphere through the grate, the water of the seals, as soon as each withdrawal of gas is complete, falls again to about its former level, and thus ensures that the gas shall flow from the producer to the cooling plant at a comparatively uniform rate.

According to the second part of the invention, the air for combustion is taken through a saturator, which consists of a steam-nozzle delivering a jet of steam through a chamber communicating on the one hand with the atmosphere (directly or through a superheater) and, on the other hand, communicating with the fuel chamber of the producer—the two communications being provided (if desired) with valves for the regulation of one or both. The communication with the fuel chamber (above the point at which the gas is drawn off) is for the purpose of drawing over the moisture and vapour given off by the newly-fed fuel. The mixture of moisture, vapour, and air thus obtained is then delivered by the steam jet into the ash pit through a contracted channel or conduit, the open end of which comes immediately opposite—but a slight distance from—the end of a larger pipe or conduit open to the atmosphere. With no other outlet, the mixture thus delivered into the

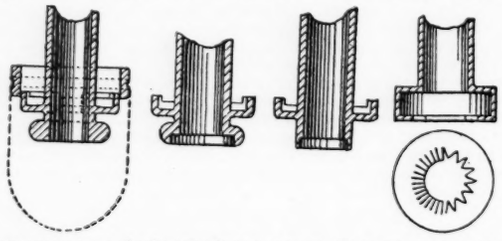
ash pit it is drawn through the generator, and any additional air required for the plant is drawn through the open conduit; while should the supply exceed the requirements, the surplus passes away through the said pipe to the atmosphere—thus practically ensuring uniformity of mixture in the ash pit, and consequently a "uniform quality of gas."

According to the third part of the invention, the steam for working the saturator is, by preference, obtained by utilizing the heat of the gas as it leaves the producer; and the gas as it leaves the cooler passes through a jacketed pipe, which serves as a heater for the air taken through the saturator.

Inverted Incandescent Gas-Burners.—Kay, M., of Clapton, N.E. No. 13,873; June 18, 1904.

To "so materially improve the burner that the mantle is as fully incandescent in the upper part as in the rest of the mantle," the patentee provides the bottom of the burner mouth with an outer bulge or rounded flange, the effect of which is that the outer zone of the gaseous mixture here issuing is thrown out towards the interior of the mantle in such a way as to afford a longer passage and a longer time for the more intimate mixture, and consequent more perfect combustion, of the gas and air in the ascent to the top of the mantle—"this outer zone of the entering gases being as it were thrown into the burning gases rising from the lower section of the mantle, the flange producing a narrowing or throat within the mantle at a point an appreciable distance below the mouth of the mantle."

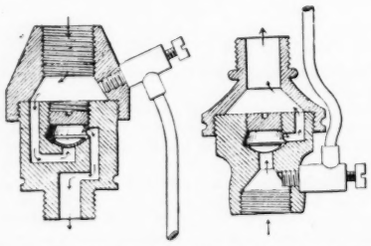
Various forms of the burner made according to this invention are shown. In the first the point of the burner tube which delivers the air and gas mixture to the mantle is provided with an annular outer bulge or rounded flange. In the second, an annular recess is formed in this flanged bottom, "which tends to throw the outer zone of the



issuing gases towards the interior of the mantle and to cause the gas and air to be more intimately mixed." The end of the third burner-tube is unprovided with a bulge or flange but has an annular recess. As a further modification, the lower end of the burner-tube may be provided with a hollow enlargement forming a recess and have inwardly projecting circumferential corrugations or saw cuts, or teeth (both being shown) "for the purpose of more thoroughly disturbing and mixing the gases."

Controlling Devices for Incandescence Gas-Lamps.—Hinton, E., and Andrews, F. A., of New Bond Street, W. No. 16,722; July 29, 1904.

This means for controlling the supply of gas to incandescence gas-lamps has reference more especially to the type in which a valve, lying normally on its seat, is caused to rise under the pressure of the entering gas, and thereby to open communication between the gas-supply pipe and the burner. The object aimed at is to so construct these devices as to allow the valve free action and thereby prevent it jamming or fixing, and also to permit the application of the device to inverted incandescence gas-lamps.



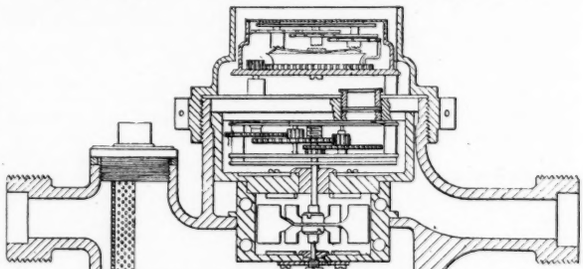
The device is constructed in two main parts, one of which forms a chamber or compartment to contain the valve, the other to form a cap for the chamber. When the device first shown is used in connection with an inverted burner, the cap is connected with the gas-supply pipe; while when the second device is used in connection with an ordinary vertical type of burner, the supply pipe is connected with the lower chamber or compartment. The inner wall of the chamber is, in both cases, formed with an outward slope, as shown, and surrounds the valve, which (instead of being of the usual ball or piston type) is formed as a cup or dished disc. The lift of this valve is limited by a plug screwed into the compartment; and when the device is for use with an inverted burner, the plug is screwed down below the level of the chamber so as to form a receptacle for any dust which may fall down the supply pipe. As shown by the arrows, the gas enters at the top or bottom as the case may be, and, raising the valve from its seat, passes through an orifice in the splayed wall, and finally issues through an outlet passage to the burner. Thus, owing to the splayed form given to the inner wall of the chamber, there is ample clearance for the valve, and any lateral movement imparted to this latter by the pressure of gas will be arrested by the splayed wall, against which it will be impossible for the valve to jamb or lodge. When the gas supply is shut off, the valve falls freely by gravity on to its seat. In both constructions a bye-pass is fitted in such a manner that the gas passing through it is not controlled by the valve but (as usual) by the main cock or tap.

Water and Other Liquid Meters.—Stern, H., of Luxembourg. No. 17,027; Aug. 3, 1904.

This invention primarily relates to a type of registering mechanism for water-meters which "until now has not been employed for apparatus of this kind." The recorders used heretofore in water-meters comprised a certain number of toothed wheels (up to 26) gearing one with the other, and several indicating discs arranged side by side, over which pointers moved to indicate the quantity of liquid which had passed through the meter. The disadvantage of this construction is said to consist in the fact that, by reason of the complication of the gearing, stoppages and disorders are frequent—for instance, wedging, fracture of the teeth of the wheels which turn slowly, and the like. Moreover, nearly all the figures are exposed; and the pointers being small, the reading of a meter is often erroneous when the pointers are between two figures.

In the present invention, the toothed wheels of the registering mechanism turn the discs, which are furnished with figures upon their periphery or upon their surface, and which are covered or obscured by a disc of metal or other material having perforations in such manner that only one figure of each disc is visible through the perforations. By preference, the disposition is such that the perforations of the metal plate are situated side by side, or adjacent to each other, in such manner that the figures which appear through the perforations combine to form a number composed of several numerals. Transmission of rotary movement of the discs from one to the other takes place in such a manner that they move intermittently, and each time by one division only, by means of a tappet "Geneva stop," or other suitable gearing. After the passage of the unit of volume which corresponds to the respective disc, they then keep the same position and are not moved forward again until a new unit of quantity has passed.

The main shaft, which is turned by the action of the water on (say) a helix carried by the shaft, sets in motion the train of wheels shown in the illustration, which, by their rotation, cause the advance of the discs periodically in the manner described. By employing a second



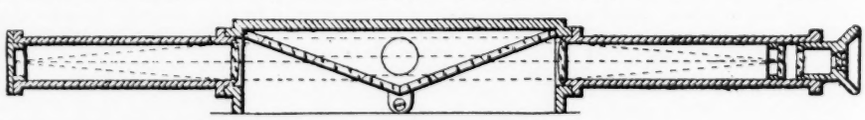
series of indicating discs, the apparatus can also register, in addition to the quantity, the cost of the water passed through; and the figures combine in the manner indicated above, so that they can be read directly.

Then, again, water-meters which are exposed to frost frequently burst, and the cost of repair is considerable. The present invention ensures protection against the effects of freezing by providing a membrane or diaphragm (made conveniently of thin tin plate fitted in an absolutely water-tight manner, but so as to be easily changed) over an orifice formed at a convenient place in the side walls of the casing or in the cover of the meter-casing. When the water in the meter freezes, this membrane dilates or deflects and prevents bursting taking place; and even should the membrane or diaphragm break, it could be easily replaced. In one convenient construction of meter the water enters by a conduit into the box or chamber containing the helix or paddles at the lower part of the chamber. The chamber in its upper part contains the clockwork mechanism, and is closed on top by a plate which has an orifice in which the diaphragm or membrane of thin sheet metal or the like is mounted water-tight by packing rings and a sleeve or socket screwed into the orifice. In the same manner, the bottom of the box may have another orifice, also furnished with a similar membrane or diaphragm.

Testing the Composition of Gaseous Mixtures.—Haber (Professor) F. of Karlsruhe, Germany. No. 18,047; Aug. 20, 1904.

The principle of this invention consists in observing or measuring the amount of refraction which a beam of light suffers when it passes—in a direction other than normal to the contiguous surfaces—from one gas, or gaseous mixture, to another; the two gases lying, at the time of the test, under the same conditions of temperature and pressure.

The method has the advantage that the results can be measured by the eye on a scale, or registered by photography, and referred to a fundamental physical magnitude—viz., the refractive index; and also



that the gas which serves as a standard, and the gas whose qualitative composition is known, but whose quantitative composition has to be estimated, need not be brought to normal temperature and pressure, provided they both stand at the same pressure and temperature.

The standard may be air—*i.e.*, an unconfined or confined portion of the atmosphere, any convenient gaseous individual or mixture of known composition, or some of the gas under examination from which one constituent has been removed by absorption. Air makes the most convenient standard when it is possible to bring the other gas to atmospheric pressure—say, by permitting it to flow freely through the observation chamber into the surrounding air. If the gas is at a much higher or lower pressure than that of the atmosphere, it and the standard may be drawn or forced through the apparatus by a common machine—throttle-valves being used to equalize the two pressures. Equality of temperature will, in general, be ensured by the contact of the gases with the walls of the apparatus.

In order to avoid the disturbing influence of chromatic dispersion, monochromatic light may be employed, or the refraction (and therefore the dispersion) may be kept small. If the deflection is too small for observation, it may be increased by leading the beam of light from the gas to the standard and back again several times.

The apparatus employed consists (as shown) of a central chamber through which a parallel pencil of light travels longitudinally in a horizontal direction. Obliquely disposed in this chamber are two transverse plates of glass, with plane and parallel sides, which meet at the centre of the base. Hence the central portion of the chamber is a prism or inverted cone, the major axis of which is at right angles to the path of the light. The central portion contains the gas or gaseous mixture to be examined. The standard gas lies outside the prism at either end of the chamber, in a receptacle which, when unconfined air is employed, may have no base. Thus the light first travels through the standard; it next passes through one glass into the gas of unknown composition at an oblique angle; and then, at a similarly oblique angle, it passes through the second glass from the unknown gas into the standard again—twice experiencing refraction (assuming, of course, that the two gases possess different refractive powers when at the same temperature and pressure).

At one extremity of the chamber is a tube bearing a converging lens at its inner end, and a slit at the other, before which any suitable source of light is placed. At the opposite extremity is a similar tube containing first a collecting lens, and then an eye-piece, the front focal plane of which coincides with the back focal plane of the collecting lens—the whole forming an astronomical telescope. The extent to which the pencil of light has been displaced by refraction may be measured either by bringing a scale graduated empirically by the results of previous observations into the focus of the eye-piece, or by having a mark there to which the image of the original slit must be brought by the rotation of a prismatic compensator attached to a micrometer screw. If preferred, the eye-piece may be removed to make room for a camera—the collecting lens then acting as objective. Other optical arrangements are described in the specification.

Bucket Conveyors and Elevators.—Dempster and Sons, Limited, and Broadhead, J. W., of Elland. No. 17,052; Aug. 4, 1904.

This invention has reference to bucket conveyors and elevators in which the buckets are retained in a horizontal position by the force of gravity, and are provided at either side with overlapping lips or flanges; the object being "to construct a conveyor or elevator which will run more smoothly than those at present in use, and at the same time ensure delivery by the buckets of the whole of their load."

The arrangement here referred to was fully described and illustrated in the "JOURNAL" for Nov. 1 and 8, 1904, pp. 329, 410.

APPLICATIONS FOR LETTERS PATENT.

12,443.—DRURY, C. DRU, "Stop valves and the like." June 15.
13,170.—CLARK, W., "Gas-checks." A communication from P. Reiss. June 26.
13,231.—SOWDEN, W., "Gas-stoves." June 27.
13,263.—HARDER, W. L., "Gas-furnaces." June 27.
13,265.—MARK DUFFIELD AND SONS, LTD., and WORSFOLD, J., "Atmospheric gas-burners." June 27.
13,266.—MARK DUFFIELD AND SONS, LTD., and WORSFOLD, J., "Gas-pendants." June 27.
13,267.—MARK DUFFIELD AND SONS, LTD., and WORSFIELD, J., "Lanterns for inverted burners." June 27.
13,311.—RICE, E. S., and STRAITON, J., "Gas appliances for lighting fires." June 28.
13,318.—BIHELLER, S., "Inverted burners." June 28.
13,352.—GAS-MOTOREN-FABRIK DEUTZ, "Gas-turbines." June 28.
13,420.—RATCLIFF, T. C. S., and MOSS, C. E. G., "Gas-pendants," June 29.
13,430—TOURTEL, J. M., "Prepayment meters." June 29.
13,432.—MANEY, W. T., "Gas-fixtures." June 29.
13,473.—STODOLA, A., "Gas-turbines." June 29.
13,490.—BATCHELOR, J. G. H. & C. T., "Supplying combustion motors with gas under pressure from suction-producers." July 1.
13,495.—HALL-BROWN, E., "Gas-producers." July 1.
13,546-7.—SCHOTT, O., "Gas-chimneys." July 1.
13,553.—CARPENTER, C. C., "Gas-burners." July 1.
13,568.—SCOTT-SNELL, E., "Gas-plant and motor." July 1.

The Philadelphia City Councils and the Gas-Works.—It will probably be remembered that the proposal to extend the lease of the Philadelphia Gas-Works to the United Gas Improvement Company was rejected a few weeks ago, mainly owing to the strong action of the Mayor. The citizens are now occupied with the question of taking over the works in 1907, under the term of the existing lease; and should this action be determined upon, the authorities will, it is estimated, have to pay the Company something like $20,000,000. The total is made up as follows: Expenditures to end of lease, $13,608,935; interest thereon, $4,680,000; Twenty-fifth Ward plant, $1,060,000; interest thereon, $636,000. This is more than the city, in its present financial condition, can spare; so that a Committee of Ways and Means will probably have to be appointed to ascertain how the money is to be raised.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills read the first time and referred to the Examiners: Inverness Gas and Water Provisional Order Bill, Malvern Water Bill.
Bill read a second time: South Barracas (Buenos Ayres) Gas Bill.
Bills reported: Andover Lighting and Power Bill, Bootle Corporation Bill, London Gas Bill, Rhymney and Aber Valleys Gas and Water Bill, Skegness Water Bill.
Bills read the third time and passed: Hitchin and District Gas Bill, Rhymney and Aber Valleys Gas and Water Bill.

The Bolton Corporation Bill and the Rhondda Urban District Council Bill have been referred to a Select Committee, consisting of the Duke of Northumberland (Chairman), Earl Fitzwilliam, the Earl of Westmeath, Earl Craven, and Lord Clinton; to meet to-day.

HOUSE OF COMMONS.

Tuesday, July 4.

THE LIGHTING OF PARLIAMENT SQUARE.

Sir W. FOSTER asked the honorable member for Chorley, as representing the First Commissioner of Works, whether the Office of Works intervened in October, 1904, when the Westminster City Council were about to conclude a contract for the better lighting of Parliament Square. If so, what steps had since been taken to improve the lighting of the square. He also wished to know if the square would continue to be lighted by the Office of Works, or whether the Westminster City Council would be allowed to do the work.

Lord BALCARRES: Parliament Square lies within the jurisdiction of the Office of Works, and the Westminster City Council have, therefore, no power to conclude any contract for the lighting of it. Experiments have been made by the Office of Works to determine what method of improved lighting should be adopted. It is proposed to light the square with the lamp which has proved so successful in New Palace Yard; and it is expected that the work will be carried out in the autumn, so that the lamps may be available before the winter.

Thursday, July 6.

PUMPING OPERATIONS AT DARENTH.

Mr. PIKE PEASE asked the President of the Local Government Board whether the Medical Officer of Health had reported to the Dartford Rural District Council that the pumping-station at Darenth, Kent, sucks the adjacent surface springs to such an extent that they ebb and flow according to the pumping. He pointed out that this water must be liable to pollution; and asked when the inquiry into this matter asked for by householders on March 22, 1904, would take place.

Mr. GERALD BALFOUR said he understood that the Medical Officer of Health had made a report to the effect referred to by the honourable member. When the undertaking of the Kent Water Company passed into the hands of the Metropolitan Water Board, the Local Government Board called the attention of that Board to the matter. They had made a series of tests, which had just been concluded; and he was awaiting a report as to the result.

The following further progress has been made with Bills:—

Bill brought from the Lords, read the first time, and referred to the Examiners: Rhymney and Aber Valleys Gas and Water Bill.
Lords Bills read a second time and committed: Blackpool Improvement Bill, Gas and Water Orders Confirmation Bill, Shepton Mallet Gas Company (Electric Lighting) Bill.
Lords Bill reported: Bangor (County Down) Water and Improvement Bill, Gas Orders Confirmation Bill, Llandrindod Wells Urban District Council Bill, Matlock Bath Improvement Bill, Western Valleys (Mon.) Water and Gas Bill.
Bills read the third time and passed: Inverness Gas and Water Provisional Order Bill, Hythe Corporation Bill [Lords], Malvern Water Bill, Mansfield Corporation Bill [Lords].

New River Company, Limited.—Pursuant to the Act obtained last year, the New River Company, for so many years associated with the supply of water in London, has been registered as a joint-stock undertaking, so as to enable the Company to continue business as the owners of landed estate, houses, and property. The capital is £240,000, in £1 shares, and the number required to be allotted as fully-paid is stated to be 130,000. The Directors' qualification is 500 shares; and their remuneration is to be fixed by the Company.

Brussels Municipal Gas Supply.—During last year there were produced in the Brussels Gas-Works 43 million cubic metres, or 1517 million cubic feet, of gas, compared with 42,047,270 cubic metres, or 1484¼ million cubic feet, in 1903. In the production of this bulk of gas 109,454 tons of coal and 4182 tons of oil were used, against 110,918 tons and 3714 tons respectively in the preceding year. The gas was conveyed to the consumers through nearly 200,000 yards of mains and 5810 rising pipes. The number of interior installations at the end of the year was 14,421, compared with 13,816 at the close of 1903. The consumers had 36,123 meters, 26,388 stoves, and 411 engines—representing 4183-horse power—employed in various industrial operations. For the public lighting, 6746 lanterns were required. They were all fitted with incandescent burners; and their period of lighting was, on an average, 3847 hours.

LONDON GAS BILL.

House of Lords Committee—Tuesday, July 4.

(*Before the Earl of* ROSSE, *Chairman*, *Duke of* WELLINGTON, *Marquis of* WINCHESTER, *Earl of* GAINSBOROUGH, *and Lord* MOSTYN.)

The proceedings on this Bill, which were adjourned on June 5, were resumed to-day.

Sir RALPH LITTLER said the London County Council were very anxious that the time of the two Committees of Parliament should not be wasted, and that if possible they should come to some method of agreement with the Companies, though they attached so much importance to the matter that they did not feel disposed to let clauses go which were entirely in favour of the Companies without the other points being duly considered. After careful discussion, they had now arrived at certain clauses. First of all, new clause 3 provided :—

The Gas Referees shall from time to time prescribe the burner for testing the illuminating power of the gas supplied by the Company and the chimney (if any) to be used with such burner. The burner so prescribed shall be of such a pattern (not being an incandescent or similar burner) as shall be practicable for use by the consumer; and the burner and the chimney (if any) shall be the most suitable for obtaining, and in making the test shall be so used as to obtain, from the gas, when consumed at the rate of 5 cubic feet an hour, the greatest amount of light.

There was no question arising upon that. Then, coming to the illuminating power, in clause 4 they differentiated in this way :—

The gas supplied by the Gaslight and Coke Company shall, with respect to its illuminating power, be such as to produce, when consumed at the rate of 5 cubic feet an hour, in the burner prescribed as hereinbefore provided, a light equal in intensity to 16 sperm candles of six to the pound, and each consuming 120 grains an hour.

The gas supplied by the South Metropolitan Gas Company and the Commercial Gas Company respectively shall, with respect to its illuminating power, be such as to produce, when consumed at the rate of 5 cubic feet an hour, in the burner prescribed as hereinbefore provided, a light equal in intensity to 14 sperm candles of six to the pound, and each consuming 120 grains an hour.

There arose one very serious question—viz., as to the tests. When they had the old burner, and when the County Council were asking for entirely different legislation, on the Gas Companies making the same objection before the other House as they had done before their Lordships—viz., that they were put under a difficulty and an injustice—the Chairman suggested that, instead of three tests on the same day, it should be an average of three days' testing; and this had been agreed to. But the Gas Companies were now still asking for the average of three days' testing, notwithstanding that they had obtained a decision of their Lordships to a very considerable extent their own way. Clause 8 of the Gaslight and Coke and Other Gas Companies' Amendment Act of 1880, which was still in operation, said :

The average of all the testings at any one testing-place on each day of the illuminating power of the gas supplied by the Company at such testing-place shall be deemed to represent the illuminating power of such gas on that day at such testing-place.

On the suggestion of the Chairman, in the hope that they might reach finality in the matter, the County Council gave way, and said there was no great difficulty in it; but since then they had had an opportunity of considering it very much more carefully, and they thought there was very great difficulty. He submitted very strongly that now that a test had been provided which was to the Companies' minds a reasonable test, there was no possible ground on which their Lordships would feel it right to alter the law which had been in existence since 1880. Therefore, what the County Council submitted was that, as they had altered the testing to meet the Companies' views, they ought not to be asked now, under entirely different circumstances, to do that which they had thought at the time was the correct thing to do—viz., to give an average of three days' testing. He was advised that the practical result of this would be that the Companies would hardly ever come under a penalty. He was not going to suggest that they would devise means of escaping the penalty; but if they wished they could certainly do it. If they had inferior gas on one occasion and excellent gas on the second and third, they would average the whole; and under other management and under other circumstances, there might thus be a misrepresentation to the public and an evasion of the Act. He was not suggesting that anyone belonging to the Companies would propose to do this; but it was open to that. In addition, it was clearly open to this: Supposing, by oversight or something of the kind, such as would not relieve them of the penalty before the Gas Referees, they got below the standard, and got above it the next time, they would be all right. This did not seem reasonable when there was a method of testing with which the Companies were contented. When they were discontented with the test, it was a concession to them which might reasonably be made. In case of accident, they had an appeal; so that unless it was deliberately done, or done by reason of some negligence, or through purchasing inferior things, or something of that kind, the Companies were perfectly safe. The County Council had bowed to the ruling of the Committee, and had given the Companies a great concession in the matter of testing, and the further important privilege of exemption from the sulphur tests. Under these circumstances, the Council thought it was very unreasonable for the Companies to ask their Lordships to do that which would probably entirely exempt them from penalty. If the three days' testing were continued, the Council would probably be compelled to come to Parliament again. He did not throw this out as a threat in the least, but merely stated the fact. If the tests were absolutely reliable, why alter the existing law? He asked their Lordships to say that, if they were to have the new method of testing, they should go back to the old rule of clause 8 of the Act of 1880. One exemption from forfeiture possessed by the Companies was clause 17 of the Act of 1880 :—

No forfeiture shall be incurred in any case with respect to which it is certified by the Chief Gas Examiner that the defect of illuminating power, excess of impurity, or insufficiency of pressure was occasioned by an unavoidable cause or accident.

Mr. BALFOUR BROWNE said the attitude taken up by the promoters was scarcely a fair one. Their Lordships had given a decision upon the last day they sat, that the old method of testing—the one inaugurated by the Act of 1900—was to be adhered to. His learned friends then said if that was to be the case they would withdraw the Bill. The Companies thought it most unfortunate that the Bill should be withdrawn after the matter had been discussed at great length before their Lordships and before the other House; and an adjournment was suggested. The adjournment had taken place; and he was glad to say that upon this matter an arrangement had been come to. It was not altogether to their liking; they would very much have liked to have their Lordships' decision stand. But there were other important matters in the Bill with regard to sulphur and other things, which they thought should not be thrown over. His learned friend said they accepted the method of testing because it was a perfect one. Do not let it be understood at all that they said it was a perfect method, because they had given up one of their principles—viz., that it should not be at the rate of 5 cubic feet an hour, but that it ought to be regulated according to the quantity of gas consumed. But this was what they had agreed: "The Gas Referees shall from time to time prescribe the burner for testing the illuminating power of the gas supplied by the Company and the chimney (if any) to be used with such burner." This did go to some extent to meet their objection, because they said that if the burner was fixed, and the rate of supply was fixed, one never could get a satisfactory result; and the clause gave the Gas Referees power to prescribe a burner for testing the illuminating power of the gas. It also directed that "the burner so prescribed shall be of such a pattern (not being an incandescent or similar burner) as shall be practicable for use by the consumer." This was to secure that the test should be a practicable one, and should show the gas the Companies were supplying to the people of London. "And the burner and the chimney (if any) shall be the most suitable for obtaining, and in making the test shall be so used as to obtain, from the gas, when consumed at the rate of 5 cubic feet an hour, the greatest amount of light." This was fair; but at the same time it was not a perfect test. Scientifically it was not a perfect test; but for the sake of peace, for the sake of getting other advantages from the Bill, they agreed to accept this clause. And now his learned friend said, "We agree; but I want you to strike out of the Bill something which I myself put in." His friend was bound by his Bill; and the important clause which he was now asking to strike out was clause 3, subsection 3.

Sir RALPH LITTLER said it might be imagined, from what his friend said, that the point was only just started.

Mr. BALFOUR BROWNE : I did not suggest that.

Sir RALPH LITTLER held that it had been the contention all the way through.

Mr. BALFOUR BROWNE said the Bill was that of the County Council, not the Gas Companies. The promoters accepted it from the Commons with this clause in; and now, because they had agreed to something which half carried out their Lordships' decision, they wanted to take away what the Commons said they were to put in and what was put in. Sub-section 3 of clause 4 was as follows:

If on any one day the gas supplied by the Company at any testing-place is of less illuminating power than it ought to be under the Special Act, the average of all the testings made at such testing-place on that day and on the preceding day and on the following day shall be deemed to represent the illuminating power of the gas on such one day at such testing-place.

This was suggested by the Committee of the House of Commons; and the promoters accepted it, and brought it up to their Lordships' House, and they had no right, when they brought up a Bill, to ask their Lordships to alter it. Was it a fair clause? All it did was this. If, owing to accident, say the South Metropolitan gas of 14-candle power should on one day be 13 candles, then, without the clause, he would be liable to a penalty merely by reason of the accident. But the clause said that if on the day before they gave 15-candle power and on the day after 15-candle power, that was above what they were bound to supply; and the average of this was still above 14-candle power, and the Company should not be liable to a penalty. Surely this was a perfectly fair thing. He did not wonder the promoters had accepted it when it was proposed by the Committee of the other House. He asked their Lordships to say that the clause should remain part of the Bill.

Sir RALPH LITTLER said his friend had based his argument on accident, but clause 17 provided for accident.

Mr. BALFOUR BROWNE : Only unavoidable accident. May I point out this clause was before the Committee of the other House. They knew that quite well, and yet they inserted this.

The Committee Room was cleared. On the re-admission of parties,

The CHAIRMAN said : The Committee propose to leave subsection 3 of clause 4 in the Bill; but they think that there should be a proviso that the deficiency in quality on any one day should not exceed a certain limit—say, 1 candle. It would be very inconvenient that this should be entirely unlimited, because it is not the same thing for a strong gas to be supplied one day to make up for a weak one on another day. We think there should be some steadiness in the supply. As it stands now, there is no limit to what it may be on any one day.

Sir RALPH LITTLER said the Companies had at present half-a-candle margin, and, of course, this would not be additional—it would be a candle margin from the prescribed illuminating power. He thought he could advise his clients to accept this. They would rather make an end than have another contest with the Gas Companies or trouble Parliament again. He understood their Lordships did not mean there should be another candle in addition to the half-candle they had.

The CHAIRMAN said the Committee's idea was that it should not be 2 candles below on any one day.

Sir RALPH LITTLER said this was how he read it—that the deficiency in illuminating power on any one day should not exceed 1 candle.

The CHAIRMAN : Yes.

Sir RALPH LITTLER said he could advise his clients to accept this, and they would see how it worked in future. He hoped that it would work well.

After a short pause,

Mr. FREEMAN said they had agreed on a clause to carry out the decision of the Committee. It was the same clause, but limited:

If on any one day the gas supplied by the Company at any testing-place is of less illuminating power, *to an extent not exceeding 1 candle*, than it ought to be, &c.

The CHAIRMAN: Yes. Do the other side agree to it?

Mr. ROSTRON: Yes, my lord.

Mr. FREEMAN said there was one thing he was asked to state on behalf of both parties. The Bill as it stood came into force on Jan. 1. The Companies pointed out that this was rather an awkward time to change over, because it was the busiest time of their work; and they desired that the Bill should come into operation at an earlier date—say, October. The promoters were perfectly prepared to meet them on this point; but the difficulty was that the Gas Referees could not prescribe a new burner before January. Therefore he suggested that the Bill should remain with the 1st of January as the date on which it should come into operation. But inasmuch as the sulphur tests had been abolished from the date of the Bill coming into operation, the Council, if the Committee thought it reasonable, should not enforce any sulphur test during the three months from October to January, although nominally they would still have power to do so. If the Committee considered this was a reasonable thing, he thought the Council would be quite prepared to accept it.

The CHAIRMAN said he did not know how it could be done, because the Committee had been through the clauses, and the Bill had passed out of their hands.

Mr. FREEMAN said they did not propose to alter the Bill. Their Lordships were fully conversant with the whole matter; and if they would express the opinion that it was a reasonable thing to do, the Council would be able to carry it out easily. The Companies desired it, too.

The CHAIRMAN (after a brief consultation with the Committee) said it was a purely voluntary matter, and they must leave it to the parties not to quarrel unnecessarily.

Mr. FREEMAN said they must be content to take it in that way.

GAS COMPANIES AND ELECTRIC LIGHTING ORDERS.

The Select Committee of the House of Lords presided over by the Earl of LAUDERDALE had under consideration last Tuesday several Provisional Orders in respect to electric lighting which had been granted by the Board of Trade, and for which confirmation was now sought.

GRAVESEND ELECTRIC LIGHTING ORDER.

By this Order the Corporation of Gravesend sought powers to supply electricity in Northfleet. Opposition was offered by, among others, the Northfleet and Greenhithe Gas Company, the Gravesend and Milton Water-Works Company, and the Gravesend and Milton Gaslight Company.

Mr. WEDDERBURN, K.C., appeared for the promoters; Mr. HUTCHINSON represented the Gas and Water Companies in opposition.

Mr. WEDDERBURN, in opening, said this Order was the Gravesend Electric Lighting Order, and by it they sought to extend the powers of the Gravesend Corporation to supply electricity in Northfleet. The Northfleet Urban District Council secured an Order in 1901. They had, however, done nothing under it; and the present Order proposed to repeal that Order in favour of the Gravesend Corporation. The Gravesend Corporation already had electricity works; and the initial outlay to give supply in Northfleet would be £2500. The local Gas Company opposed on the ground of competition; but he contended that they had no *locus*, inasmuch as the Northfleet Council could now erect their own works, and no new competition was being introduced. He also submitted that, so far as the *locus* of the Companies was concerned as ratepayers, they were bound by the Common Seal. The promoters also were not seeking to extend their area.

Mr. HUTCHINSON said he was there representing individuals—not as ratepayers *qua* ratepayers only, but as owners of property which might under this Order become subject to the incidence of new and increased taxation.

Mr. WEDDERBURN: There is no allegation of ownership in any one of these petitions.

After considerable argument, the Committee decided to grant the *locus* asked for.

Mr. WEDDERBURN said he ventured to think that the real matter that was asked for here was the Bermondsey clause, which the Board of Trade had refused to insert. This clause, no doubt, in a good many cases, had been inserted; and when a certain number of cases came before the Duke of Northumberland's Committee last year, the clause was put in. But no case came before that Committee which was similar to this one. The objection to the clause was that very often they might for a longer period than three years, in order to catch custom, have to work at a loss, just as a company had frequently to do. Then it was a very handicapping thing to have to estimate how much they had to charge in order that there might be no loss. It was difficult to estimate exactly; and it meant that they might have to charge a little too high a price for electric light, with the result that they checked custom. In all the cases coming before the Duke of Northumberland's Committee, it was sought to alter the electric lighting area, or it was shown that there had been culpable bad management on the part of the undertakers. He did not think Mr. Hutchinson would be able to prove that there had been any culpable mis-management by the Gravesend undertakers. They were not seeking to alter the area, but only the method by which it was to be supplied. If this Order was rejected, Gravesend would still retain their Order of 1898, and Northfleet their Order of 1901. There was no question of repealing these two Orders; it was only a matter of altering the method.

Mr. *G. M. Arnold*, the Mayor of Gravesend, said he was thoroughly satisfied that the initial three bad years were over, and that the undertaking was now one which would work at a profit. They expended some £50,000 on the generating station and so on; and at one time there was a loss amounting to nearly £3000. This was due to the fact that they had a long and unsuccessful law suit with the Contractor. But, in spite of this, they had turned the corner and showed a profit. He thought that the best thing to do in the public interest was the extension to Northfleet.

Mr. HUTCHINSON said he was not going to direct himself to the Bermondsey clause; he was going to ask the Committee to reject the Order. He went on to cross-examine witness with a view to proving that the management expenses shown were very much below what they were in similar undertakings; that there was nothing in the accounts for depreciation of plant; that in the agreement the promoters were to pay Northfleet £250 as the cost of obtaining their 1901 Order; that the present Order would cost some hundreds of pounds; and that the light which would be supplied would not pay for the heavy outlays.

Mr. *H. H. Brown*, the Town Clerk of Gravesend, Mr. *C. F. M'Innes*, Mr. *A. Tolhurst*, J.P., and Mr. *A. E. Radcliffe* also gave evidence.

Mr. HUTCHINSON said he thought the promoters had failed in their own case. Northfleet already had the advantages they were asking for. They had an Electric Lighting Order; and, if there had been all this demand, Northfleet would not have been resting on their oars for three or four years. He said it was vicious in principle that, when Parliament had already granted powers for something to be done for the benefit of the public extending over a certain area, one rival promoter should be permitted to come to Parliament and say: "Snuff out the other promoter who has powers, and give me powers." Gravesend had shown that they had contracted to pay to Northfleet for the privilege of abolishing their Order—a concession from Parliament that ought to have been duly regarded—£300, and, in addition to this, they were also going to pay for the cost of the Order to replace the one which they were asking the Committee to abolish. A community should not be allowed to use the rates of their own borough for providing something for a neighbouring authority. He did not know of any such precedent. This was the worst form of municipal trading.

The CHAIRMAN said the Committee had decided that the Bill could proceed.

Mr. HUTCHINSON then said he should bring forward the Bermondsey clause. The object of this clause was to provide against a charge upon the rates, which had already occurred in Gravesend. Only the year before last there was a loss of £3000, and during the past year they had only just turned the corner—about £29 in hand, and this without anything for depreciation. In regard to the Bills before the Duke of Northumberland's Committee, the Watford case, in which the Committee imposed the clause, was analogous to the present case.

Mr. WEDDERBURN said that this clause ought not to be imposed just when the undertaking was turning the corner—putting upon them what was in effect a penalizing clause. This was not in any way parallel with the Watford case, because Watford was seeking to extend their electric lighting area, and gross mismanagement was also urged against Watford.

The CHAIRMAN: The Committee are against the clause being put in the Order.

THAMES CONSERVANCY BILL.

PETITION OF THE LONDON GAS COMPANIES—THE BRENTFORD COMPANY'S POSITION.

House of Commons Committee—Thursday, July 6.

(*Before Sir* JOHN BRUNNER, *Chairman*, *Captain* BAGOT, *Mr.* FITZROY, *and Mr.* HAVILAND-BURKE.)

The objects of this Bill have now been reduced to imposing upon the Conservancy the duty of exercising powers, which they already possess, of making a deep-water channel, 30 feet deep and 1000 feet wide, between the Nore Lightship and Gravesend—a distance of about 21 miles—and, to meet the cost of dredging, &c., to empower the Conservancy to double the dues for a period of three years.

The Bill was opposed by several petitioners, among them the South Metropolitan Gas Company, the Gaslight and Coke Company, the Commercial Gas Company, and the Brentford Gas Company.

Mr. R. NEVILLE, who appeared for all the Companies named, said he would call his evidence first.

Mr. *James Husband*, the Engineer and Manager of the Brentford Gas Company, said they had an area of 44 square miles, and were 10 miles from London by road and 16 by river. All the coal for their riverside works was brought up by barges, towed by steam tugs from the Pool. They had to pay to the Thames Conservancy 1½d. a ton on all goods at Kew. The Company carbonized 150,000 tons of coal a year. They also used the river for bringing up and taking away coke, lime, oil, and residual products. Coal paid ½d. and oil ¾d. per ton on entering the port; and then, as it came up to Brentford, there was another 1½d. a ton to pay at Kew. This worked out, on coal, oil, and other goods, at £840, in addition to the tonnage dues in the port of £150; so that his Company paid nearly £1000 a year. The barges used were 50 ton barges, and therefore were not exempt. They would get no benefit from any dredging which was done under the Bill. The coal for their works at Southall was taken up by canal, and they also had to pay port dues.

In cross-examination by Mr. CLAUDE BAGGALLAY, witness said that port dues were paid by the ships bringing coal and other goods into the port. The Company did not own any ships. The barges only paid dues on entering the port; and as their coal only came from the Pool, the question whether they were over or under 50 tons was irrelevant.

The CHAIRMAN asked whether the Company would pay any more to the Conservancy if the Bill were passed.

Mr. CLAUDE BAGGALLAY said that there would only be an extra ¼d.,

which would be paid on entering the port. The Company would not pay this; it was paid by the ships.

Mr. NEVILLE then addressed the Committee. He said that he was appearing for the three London Gas Companies, as well as the Brentford Company; and he thought the Committee would see that the position they took up was a reasonable one. They were about the largest coal consumers in the port of London. Among them, he believed they consumed between 3 and 4 million tons of coal per annum; and, in addition to this, a large amount of residual products was carried on the river. When the Bill was deposited, they felt there was a great deal of difficulty in their assenting to the proposals; but when it was modified on second reading, most of their objections ceased to be of any force. They took up the position now that their interests were bound up with those of the City of London; and if the City were prosperous, they would get some share of that prosperity. They recognized that improvements on the river were necessary; and though they would be hit to the extent of between £3000 and £4000 a year, they said they would take up the public-spirited position and agree that the Bill should be carried through, and that it was a reasonable one. They would get the benefit out of any increase in the prosperity of London. Brentford, however, was in an entirely different position. It was 20 miles from London, and could not share in its prosperity. It already had to pay a heavy impost; and as they could get no benefit out of the Bill, it would be an extreme hardship to place upon them an extra £150 a year by doubling the tonnage dues. He submitted that it would be a fair thing to exempt them.

The CHAIRMAN: You pay, directly, nothing now. It is a little difficult to exempt you from nothing.

Mr. NEVILLE said the Company would have to pay an increased price for their coal; and he submitted that coal which had to be taken up the river beyond Kew should not pay double duty.

The CHAIRMAN: How are we to exempt you from the double duty when you do not pay it?

Mr. NEVILLE: We ask you to exempt those persons who supply us with coal.

The CHAIRMAN: In that case, the Gas Companies would be asking for more than £150 a year.

Mr. NEVILLE said that was not so. They were not asking the Committee to exempt all coal coming into London from double duty, but only that going beyond Kew.

The Committee, without giving any decision, then proceeded to consider other petitions.

Friday, July 7.

The Committee, after hearing evidence and speeches on behalf of the London Direct Short Sea Traders' Association, the Commissioners of Sewers for the Havering and other Levels, the Commissioners of Sewers for the Rainham and other Levels, and the Waterside Manufacturers, petitioning against the Bill, found the preamble proved, without calling upon Mr. Claude Baggallay for the promoters.

It was agreed that clauses should be brought up by the various petitioners on Monday; the Chairman stating that they were entitled to bring up any clauses they pleased.

Mr. NEVILLE asked if this would apply to the case of the Brentford Gas Company.

The CHAIRMAN: It will apply to every case. We shut out nobody on a discussion on clauses. You want a rebate, or something of the sort for taking your coal to Kew?

Mr. NEVILLE: Yes.

Monday, July 10.

On the meeting of the Committee this morning,

Mr. NEVILLE brought up the following clause for the protection of the Brentford Gas Company:—

The Conservators shall once in each half year during the period mentioned in the section of this Act the side-note whereof is "Temporary Increase of Tonnage Dues," repay to the Brentford Gas Company, hereinafter referred to as the Company, any increased tonnage dues which they shall during that half year have paid to the Conservators, either directly or indirectly, upon any vessels bringing into or conveying out of the Port of London any coal, oil, or other material destined to, or coming from, the Company's wharf at Brentford or the works on the Grand Junction Canal at Southall.

He said the object of the clause was simply and solely to obtain a rebate of the increased tonnage dues. The Company were just above the place where a few tolls were payable. They had to pay something like £1000 for coal, and they asked to be relieved from the additional tonnage dues.

The CHAIRMAN: The foundation of your claim I understand to be that you have to pay for the maintenance of the towing path, whereas you no longer use it.

Mr. NEVILLE: It is not used by anybody; it is a promenade. I am told we never have used it.

Mr. CLAUDE BAGGALLAY said the Thames Conservancy had to spend money in the upper parts of the lower navigation for various purposes, and it was obviously right that those persons who navigated the upper portions of the river should pay something. All the promoters proposed was to make the Brentford Gas Company pay just as other companies did for the advantages which arose from the development of the Port of London.

The CHAIRMAN: The Committee reject the clause.

MATLOCK BATH IMPROVEMENT BILL.

The Erection of New Gas-Works.

The Police and Sanitary Committee of the House of Commons presided over by Mr. J. W. WILSON had before them last Wednesday the Bill promoted by the Matlock Bath Urban District Council, which sought to authorize the erection of new gas-works, and to confer additional powers.

Mr. WEDDERBURN, K.C., appeared for the promoters. There was no opposition; but the Local Governmen Board were represented by Mr. BOYCE.

Mr. WEDDERBURN said the position in regard to gas in the district was this: In 1896, the Matlock Bath Urban District Council obtained a Transfer Act enabling them to buy up the Gas Company, who not only supplied Matlock Bath, but a far larger area outside. The Council were therefore now the Gas Authority not only for their own district, but for the outside area, with a total population of 6000. The population of Matlock Bath was only 1830. The gas undertaking had been a considerable success—some £200 or £300 being obtained from it in reduction of the rates. The Council got £10,000 for extensions and other powers in their Act; but the Matlock Bridge District Council opposed them, on the ground that the works they were buying up were in the Matlock Bridge district, and they said they caused objectionable smells, and so on, and wished them to be removed. Consequently the Matlock Bridge Urban District Council got clause 14 in the 1896 Act, by which the Matlock Bath Council came under an obligation to remove the works to their own area within seven years from the passing of the Act, which terminated in 1903. This had never been done. The reasons did not much matter, because there had been no objection by Matlock Bridge; but as a fact, although £10,000 was granted for extensions by the Act of 1896, there was no specific sum for the cost of the removal of the works. Another reason was that Matlock Bridge had never pressed them to remove them, and, in fact, in 1903 had passed a resolution delaying the matter.

The CHAIRMAN: You are a source of income to them?

Mr. WEDDERBURN: Yes; some £60 a year. In the House of Commons the opposition to the gas portion of the Bill was withdrawn, we agreeing to insert seven years as the limit of time within which we must remove the works, and to a penalty of £5 a day if they are not removed at the expiration of that period. This has been inserted in the clause, which now reads:

The time limited by section 14 (Protection of Matlock Urban District Council) of the Act of 1896 for the removal of the existing gas-works and the erection thereof upon other lands is hereby revived and extended for a period of seven years from the passing of this Act, and the Council at any time prior to the expiration of that period may, if they think fit, remove and re-erect the said gas-works to and upon the lands (as specified); and in the event of the Council not removing the said gas-works within such period as aforesaid, they shall pay to the Matlock Urban District Council a daily penalty not exceeding five pounds until such removal.

The CHAIRMAN said the removal of works was an expensive thing; and if the Matlock Bridge authorities had come to the conclusion that £60 was more valuable to them than the nuisance was an expense, it seemed to him it was a question whether, in the public interest, they should sanction the removal of the works.

Mr. WEDDERBURN said under the Act of 1896 they were compelled to remove them, and that obligation remained.

The CHAIRMAN said the promoters now came to Parliament and showed that the Matlock Bridge authorities had passed a resolution in favour of the works not being removed and desired that the power should be repealed.

Mr. WEDDERBURN said Matlock Bridge never desired it to be repealed; they were only content with delay. The consumption of gas increased each year to such an extent that the works must be removed. The present works were inconvenient and unapproached by railway.

The clause was agreed to.

Mr. WEDDERBURN said that clause 6 enabled the Council to make agreements with the Midland Railway with regard to the construction of railway sidings into the gas-works of the Council and the making of a platform or landing place on the canal at Cromford in connection with the gas-works, and also with regard to the use, management, and maintenance of the same when constructed.

The CHAIRMAN said that was a very useful clause, and the Committee agreed to it.

Mr. WEDDERBURN said clause 8 enacted, "The prescribed number of candles shall be fifteen, and section 25 of the Act of 1896 is hereby repealed." Under that section the power was 18 candles; that of the Matlock Bridge Company was 15-candle power; and he believed there was no other place in Derbyshire which had got more than this. It would save the Company £250 a year.

The clause was agreed to, as also clauses giving the Council power to lay pipes in streets not dedicated to public use, and to utilize pipes for ancillary purposes. Provision was made that no penalty should be incurred, in case of unavoidable cause, for neglect or refusal to give a supply of gas, or for insufficiency of pressure, defect of illuminating power, or excess of impurity, if the Court were of opinion that such neglect, &c., was caused by circumstances beyond the control of the Council, or was of so slight a character as not materially to affect the value of the supply.

The Committee then proceeded with other portions of the Bill. The preamble was proved.

LEGAL INTELLIGENCE.

JUDICIAL COMMITTEE OF THE PRIVY COUNCIL.

Wednesday, July 5.

(*Before Lord* MACNAGHTEN, *Lord* DAVEY, *Lord* JAMES OF HEREFORD, *and Lord* ROBERTSON.)

Melbourne and Metropolitan Board of Works and Melbourne Metropolitan Gas Company—The Rating of Gas-Mains.

Some weeks ago, a Board composed of Lord Macnaghten, Lord Davey, Sir Ford North, Sir Andrew Scobel, and Sir Arthur Wilson were engaged in hearing the arguments in an appeal from a judgment of the Supreme Court of Victoria, delivered on Aug. 12, 1903, reversing a decision given by Mr. Justice Williams in the previous April. The

question raised was whether the above-named Board were authorized to levy rates on the Gas Company in respect of mains comprised and separately valued in the valuations of the several Municipalities within which they are respectively situate; and, if so, whether such mains were to be treated for rating purposes as sewered or unsewered properties. The Board were constituted and incorporated by an Act passed in 1890; and they were entrusted with the management of the sewerage and drainage as well as the water supply. They were authorized by section 122 to prepare an annual estimate of their requirements, and then to make a rate, to be called the "Metropolitan General Rate," and to assess it upon the several municipal districts within the Metropolis, in sums bearing the same proportion to the total amount to be raised by the rate as the net annual value of the property in each municipal district bore to the total net annual value of such property in the whole Metropolis. But no rate was to exceed 1s. in the pound. The Act of 1890 was amended by one passed in 1897; and this and the succeeding section were repealed. By section 5 of the later Act, it was enacted that the Board should, after sewers had been made in any street or part of a street, cause a general notice to be given that they had made provision for carrying off the sewage of property abutting on such street, and that after such time as should be fixed by the Board, such property should be deemed and taken to be a "sewered property" within the meaning of the Act, also that every property, whether or not abutting as described, which should be connected with any sewer of the Board should be deemed to be a sewered property. By a subsequent section, the Board were authorized to levy upon such property a rate, for nine years after the commencement of the Act, at 1s. in the pound of the net annual value of the property, and thereafter a rate not exceeding this amount. On unsewered property the rate for the nine years was to be 2d. or 1d. in the pound, according to the situation of the property; but after nine years no rate was to be levied on it. It appeared that the mains of the Gas Company had been separately valued in the valuations in force in the Municipalities within which they were situate; and the claim of the Board was to enforce rates levied on the Company in respect of their mains within the Metropolis, treating them as sewered properties wherever they issued from, and were connected with, a property of the Company coming under the definition of "sewered property." On behalf of the Company it was contended that the mains were not liable to the Metropolitan general rate, and that if they were, they were not liable to be rated as sewered properties. In the Court of First Instance, Mr. Justice Williams gave judgment for the Board on the ground that the mains, being connected with the works or gasholders of the Company, and forming part of the general undertaking, were necessarily connected with the sewers of the Board, and therefore were to be deemed sewered property. On appeal, the full Court dismissed the action, holding that, inasmuch as gas-mains were not capable of being sewered, they did not come within the description of property on which the Board were authorized to levy rates, and that therefore they were not liable to be rated at all.

Mr. HALDANE, K.C., and Mr. WALTER C. RYDE appeared for the appellants; Mr. ASQUITH, K.C., Mr. DANCKWERTS, K.C., and Mr. ALAN C. NESBITT represented the respondents.

Lord MACNAGHTEN, in delivering their Lordships' considered judgment, recapitulated the facts as set forth above, and said their Lordships were unable to agree with the view taken by Mr. Justice Williams. It appeared to them that in the case of the Gas Company the subject liable to be rated was not the undertaking of the Company, but the properties comprised in the municipal valuations which the Metropolitan Board were bound to adopt, and that these properties, though comprised in the municipal valuations, were not liable to be rated as sewered properties unless they fell within the definition of such property contained in the Act of 1897. They agreed with the opinion expressed by the full Court that the mains were not sewered properties, inasmuch as they did not abut on a street or part of a street in which sewers had been laid. But, on the other hand, as gas-mains were not sewered property, their Lordships thought they must come under the head of "unsewered property," and that the circumstance that they were not in their nature capable of deriving from sewers the same benefit as houses intended for habitation, was not of itself a sufficient reason for placing them in a new category not recognized by the Act, and so relieving them from rates altogether. They would therefore humbly advise His Majesty that the order of the full Court, dated Aug. 12, 1903, and the order of the Supreme Court, dated April 28, 1903, ought to be discharged, both parties bearing their own costs in each of the Courts; and that instead of the last-named order it ought to be declared that the mains of the respondent Company comprised in the valuations of the Municipalities within which they were respectively situate were liable to be rated as unsewered property. Their Lordships thought there should be no costs of the appeal.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

(*Before the* LORD CHIEF JUSTICE *and a Special Jury.*)

Mayor, &c., of East Ham v. Ilford Gas Company.

This was an action claiming damages from the defendants for injuries done to the plaintiffs' roads, fences, and sewers, from the flood of June 15 and 16, 1903, for which it was alleged that the Company were liable on the ground of negligence.

Mr. LUSH, K.C., Mr. SHEARMAN, K.C., and Mr. LEWIS RICHARDS (instructed by Messrs. Wilson and Son) appeared for the plaintiffs; Mr. DANCKWERTS, K.C., Mr. DUKE, K.C., and Mr. S. MAYER (instructed by Mr. J. S. Tyler) represented the defendants.

The action, which was opened last Tuesday, was in substance a repetition of the case tried early in the year before Mr. Justice Darling, in which the Ocean Accident and Guarantee Corporation, Limited, were plaintiffs, when judgment was given in favour of the defendants. In the present case, as in the former one, the learned Judge said he should not trouble the Jury with the question of damages, but only to such questions of fact as bore upon the issue of liability; and, of course, any questions of law which might arise would be argued before him after the verdict, if necessary.

The evidence on the part of the plaintiffs, which extended over Wednesday, Thursday, and Friday, was practically the same as in the case mentioned, with the addition that several witnesses were called to prove that between the flood in June, 1903, and one which occurred in July, when fortunately no substantial damage was done, the defendants had formed a dam across the Aldersbrook just where it entered their premises under the Romford Road. It was suggested that it was this which prevented damage; and that if similar precautions had been taken before, the flood of June would also have been harmless.

On Friday morning, Mr. DUKE opened the case for the defendants, and commented on the fact that no claim was made by the present plaintiffs until October, 1904—considerably more than a year after the damage took place. He also said he should establish beyond controversy that the witnesses who spoke to the making of a dam before the flood of July were entirely mistaken, and that the real reason no damage was then done was because the Ilford Bridge was not blocked—as it was in June—and therefore the flood water got away down the natural channel of the Roding.

Mr. *A. A. Johnston*, the Engineer to the defendant Company, was then called; and his evidence occupied the rest of the day. He said the work done in blocking the Aldersbrook just below the bridge was commenced on the 27th of August, and finished about the end of September. Nothing was done between the June and July floods to interfere with the flow of water into the Company's premises.

Yesterday, Mr. *J. H. Brown*, the Engineer and General Manager of the Nottingham Corporation Gas Department, said that from June, 1899, to January, 1903, he was Engineer and Manager of the Ilford Gas Company. All the works were carried out under his personal superintendence, and detailed drawings were in every instance submitted and approved by the River Commissioners of the Dagenham Level. After the bank was cut to lay the main, the ground was well consolidated, and the river wall was raised and strengthened so as to protect adjoining property. In cross-examination, he admitted that the culvert was closed without first obtaining the approval of the Commissioners. Notwithstanding the Aldersbrook arches were open and the culvert closed, he considered the bank as raised was sufficiently high to prevent flood. Mr. *William Ashmole*, the Chairman of the Company), Mr. *Alfred Carter* (Marsh Bailiff of the Essex Sewage Commission), and several other witnesses, were called for the defendants, many of whom spoke to the arches of the bridge having been blocked with floating timber, thereby keeping back the water.

The further hearing was adjourned.

THE DEVONPORT SLANDER CASES.

An end has now been put to the litigation arising out of the difference of opinion between the Devonport Gas Committee and their late Engineer, Mr. Sidney E. Stevenson, on the subject of water gas. As was reported in the "JOURNAL" last week (p. 52) the action for slander brought by Mr. Stevenson against Mr. William Hornbrook, the Chairman of the Gas Committee, was settled by Mr. Hornbrook withdrawing all imputations against Mr. Stevenson and agreeing to pay £250 as damages and the costs of the action.

A second writ had been issued by Mr. Stevenson against Mr. Henry Banbury, a member of the Town Council and of the Gas Committee, in which £1000 was claimed as damages for slander. In this case the slander was alleged to have been contained in words used at a meeting of the Council on April 13. In his statement of defence, the defendant pleaded that if he spoke or published what plaintiff alleged, he did so without malice and *bonâ fide* on a privileged occasion—namely, during a debate in the Council on the question of the gas undertaking, and concerning the management by the plaintiff as a servant of the Council—and only to members and others who had a common interest with him (the defendant) in the matter, and in pursuance of his duty. Mr. Hornbrook had raised a similar defence in the action in which he was defendant; and Counsel pointed out in reference to that case that it might be difficult to decide whether the occasion of a speech in the Council by a member was a privileged one or not. In view of this uncertainty, Mr. Stevenson has discontinued his action against Mr. Banbury. The letter of Mr. Stevenson's Solicitors giving notice to this effect points out that the defendant did not attempt to justify the words imputed to him, but relied solely on the question of privilege; and seeing that the words complained of were uttered by him in his capacity as a councillor in the Council Chamber, Mr. Stevenson, in consequence of Mr. Banbury's action in so relying on privilege only, had no other course open to him but to discontinue the action. Regret is expressed in the letter that the defendant sheltered himself behind the plea of privilege. In reply, Mr. Banbury's Solicitors point out that the law affords protection to persons acting in a public capacity who have to make remarks upon the conduct of officials, and contend that it would be somewhat foolish on the part of their client to ignore this protection, and deliberately court the annoyance, worry, and expense of an action-at-law. Mr. Stevenson, they add, had the opportunity of replying to or disproving any allegations; but apparently he preferred to embark on litigation on the off-chance that Mr. Banbury would be willing to expose himself to it.

Shrewsbury Water Question.—The rival schemes for the water supply of Shrewsbury—upland and river—have again been before the Town Council, who have adopted the recommendation of the Water Committee that the two proposals should be submitted to a vote of the ratepayers—with an intimation that one or other must be carried out, and a fair statement of the estimated cost, &c. A Special Committee has been appointed to take the matter in hand.

MISCELLANEOUS NEWS.

THE PAST TWELVE MONTHS' WORKING AT BELFAST.

The statement of accounts of the Belfast Corporation Gas Department for the year to March 31 shows that there was a gross profit of £57,680 on the manufacture and sale of gas as compared with £52,077 for the previous year—or an increase of £5603. Deducting interest, &c., on capital £13,007, there is left a net profit of £44,673, as against £38,977—or an increase of £5696. It is pointed out that the profit would have been even greater on the present occasion had it not been for a change in the rate of discount, which has effected a reduction of £3950 in six months. To the net profit of £44,673 has to be added the balance from stoves account £716, and the balance from last year's accounts £24,327, making a total of £69,716. Deducting sinking fund charges, equivalent of interest on redeemed stock, and interest on insurance suspense account, leaves £60,970. Out of this, the following payments have been made for the public good. In aid of rates, £15,000; new City Hall, £6443; Library Committee, for sites, £3000; and Parks Committee, £1000—leaving a balance standing at credit of profit and loss account of £35,527. In the manufacture of 997,245,000 cubic feet of coal gas, 89,036 tons of coal were carbonized; and for 819,345,000 feet of oil gas, 2,072,593 gallons of oil were employed. The total quantity of gas made was 1,816,590,000 cubic feet, as compared with 1,803,564,000 feet in 1904; or 11,200 cubic feet per ton of coal, as against 9848 feet. The oil used per 1000 feet of gas made was 2·529 gallons. The proportion of unaccounted-for gas was 6·974 per cent. The total proceeds of residual were equal to 89·12 per cent. of the cost of coal, against 79·77 per cent. in the previous year. The number of cooking-stoves on hire is 4486, and of heating stoves 2790. There are 7992 prepayment meters in use.

Moving the adoption of the Gas Committee's report by the Council, Mr. J. A. Doran said there was only a small increase in the output, which was easily explained by the open winter and the largely increased use of incandescent mantles. From the commercial point of view, the results were most satisfactory. It would be remembered that last summer the discount allowed on prompt payment of gas accounts was increased to 10 per cent. for all consumers whose accounts did not exceed 200,000 cubic feet per quarter. This in most cases was equal to about 3d. per 1000 feet, and caused a reduction in the six months' receipts for gas of £3950. Notwithstanding this, there was a large increase in the net profit, which amounted, after payment of all charges, to £44,673, as against £38,977 for the previous year. During the twelve months over 8000 slot meters were fixed; the great majority of which were in houses where gas was not previously used. The gas consumed through these amounted to over 31 million cubic feet, and the sum received to about £4500. As there had been expended on these meters the large sum of £20,000, these receipts would not show an actual profit; but as many of the meters—most of them, in fact—had only been used for a portion of the year, the result must not be taken as an indication of the extent to which they were being used. In order to form some idea, the returns from 100 meters which had been in use a full year had been made up. These were taken at random from various parts of the city, and showed an average consumption of 8729 cubic feet. If this average was maintained, they might reckon on a consumption of at least 70 million cubic feet through these meters during the current year, bringing in a rental of about £10,000; and if this was attained the system would prove a great financial success.

The minutes were adopted.

NOTTINGHAM CORPORATION GAS SUPPLY.

Annual Report Adopted.

At their Quarterly Meeting on Monday of last week, the Nottingham City Council adopted the annual report of the Gas Committee, which was summarized in the "JOURNAL" for the 4th inst. (p. 56).

The Chairman of the Gas Committee (Mr. E. Harlow) explained at some length the main features of the report; and with regard to the falling off of 5 per cent. in the sales of gas, he remarked that the previous year had brought them an increase of 7 per cent., so that the present decrease was not so large as it appeared to be. Though the income had been smaller, the expenditure had also been considerably less; the cost of manufacture and distribution having decreased by £29,000. Of this, £21,500 was represented by a saving of about 1s. 3d. per ton in the price of coal. The result of the year's trading was a gross profit of £92,000, which was less by £5000 than the previous year's profit. He had noticed that this decrease in profit was common to almost every gas undertaking, public or private, in the country. The gross profit it was proposed should be appropriated as follows: As interest on capital invested, £46,000; to sinking fund, £8500; for depreciation or reserve, £7000; to district rate, £27,000; and to trading capital account, £3645. There had been a lot of criticism concerning the reserve funds of the undertaking. They had separately invested outside the concern over £180,000, and as reserve in the concern £66,000—in all practically £247,000, or a quarter of the capital. Since the Corporation took over the works thirty years ago, over £540,000 had been paid to the rate fund, and £220,000 had been placed to the reserve and depreciation accounts—a total of over £750,000; and in the same period the price of gas had been very materially reduced.

In the course of the subsequent discussion, one or two members complained of defective street lights; but it was pointed out that this was the fault of the Lighting Committee, and not of the Gas Committee. Mr. Sands remarked that the average number of complaints received from consumers per week had been something like one-third this year of what it was three years ago; but there had been an abnormal number on one day lately because there was a breakdown in the plant used for removing the naphthalene from the gas. Mr. Harlow added that they did not receive the complaints from private consumers that they did from the Lighting Committee. The Lighting Committee would not accept the advice of the Engineer as to the working of the lamps; and the consequences must rest with them.

LONGTON GAS AND ELECTRICITY UNDERTAKINGS.

The Past Year's Working.

At the Meeting of the Longton Town Council last Thursday, the report and accounts of the Gas and Electricity Departments for the year ended March 31 were presented. The Committee reported that the total quantity of gas made was 145,907,000 cubic feet, of which 11,316,000 cubic feet were carburetted water gas, or equal to 7·7 per cent. of the total make. Owing chiefly to the bad state of trade, the gas sold for the year showed a decrease of 3,106,000 cubic feet, or 2·3 per cent. less than in 1903-4. The revenue derived from the sale of gas, including that used for street lighting, was £22,029, being a decrease of £470. The returns from residuals showed a falling off of £1054 compared with the previous year, due to the reduced market price of tar and coke. The leakage account was at the rate of 5·4 per cent. of gas made; being a decrease of 1·6 per cent. This is one of the lowest leakages recorded for a mining district. The profit on the year's working came to £10,417. After deducting interest and sinking fund charges, amounting to £6076, and having paid over £2000 to the borough fund in relief of rates, there remained a further balance of £2340. The Committee recommended that the balance of the deficiency account in respect of the defaulting Secretary, amounting to £575 13s. 7d., should be written off, and that the remaining balance of £1765 should be credited to the gas and electricity account. The working profit from the supply of electricity for the year amounted to £693. The balance brought forward (£1583), together with interest and sinking fund charges (£1218), and the amount of capital written off (£373), made a total of £3174. From this must be deducted £693, being the surplus of the revenue account, and £1719, the amount received from the Gas Department; leaving a balance of £762. The Committee also recommended that £300 should be set aside for depreciation of plant; thus making a debit balance of £1062 to carry forward. The accounts were accompanied by a statement by the Engineer and Manager (Mr. W. Langford) of the general results of the working during the year. The quantity of coal carbonized was given as 11,370 tons; the make of gas per ton being 11,837 cubic feet, of which 11,065 cubic feet were sold. The coke made was 7390 tons, or at the rate of 13 cwt. per ton of coal used; the tar made was 742 tons; and the sulphate of ammonia, 125·75 tons. The residuals realized per ton of coal used: Coke, 4s. 6·9d.; tar, 1s. 9·9d.; sulphate, 2s. 0·2d.—making a total of 8s. 5d.

The accounts were before the Committee at their meeting on the 28th ult., when the Chairman (Alderman Brookfield) offered a few comments on them. He pointed out that the cost of manufacture was £581 less than in the preceding year, and that there had been an additional saving of £323. The profit was less by £832; but the general working results had been exceptionally good in every particular. Turning to the electric light undertaking, he called attention to various points in the accounts, and said that though there was a debit balance of £1062 to carry forward, they had a set-off in the depreciation fund of £1052, which was very gratifying. He congratulated the Manager on his efficient conduct of the works and the successful returns on the year's working. Mr. Langford also presented a report to the Committee in which he pointed out that the effect of depression in the local industry was manifested by a falling off in the demand for gas by large consumers; the number of consumers by ordinary meters being 1820, against 1843 last year, while the gas used per meter averaged 42,900 cubic feet, against 45,219 cubic feet before. On the other hand, he said it was refreshing to note that slot-meter consumers were increasing, and numbered 3870, against 3655. The average consumption of gas by these meters for the year was 10,200 cubic feet, against 10,180 cubic feet. The total quantity of gas sold in this way was 35,579,000 feet; and the amount received was £7311, against £6828. One-third of the gas sold for private lighting was supplied through prepayment meters. The total quantity of gas sold by ordinary meters was 78,149,000 cubic feet, against 83,338,000 cubic feet; being a decrease of 5,189,000 cubic feet. There were 66 gas-engines in use; and the gas thus supplied was 6d. per 1000 feet less than that used for lighting and cooking. Since the Committee reduced the price in 1902, the consumption per engine had risen from 127,000 to 150,000 cubic feet per annum, or an increase of 23,000 cubic feet; and the quantity supplied last year for motive power was 9,917,000 cubic feet, against 8,960,000 cubic feet for the preceding year—an increase of 957,000 cubic feet. Mr. Langford furnished details as to the renewals of plant carried out during the year, and reminded the Committee that the whole of the work had been paid for (including £1000 for water-gas plant) out of the profits made in the financial period covered by the accounts. He said the expenditure would be productive of a good revenue. With regard to the supply of electricity, Mr. Langford reported that the number of consumers at the close of the year was 71, being an increase of 11. The total number of units sold and used was 72,885, against 66,239 for the previous year, being an increase of 9 per cent. The number of units used for lighting was 59,311. The price paid was as follows: 28,881 units at 8d., 29,170 units at 2d., and 1260 units at 4½d. The number used for electric motors was 9052; the price paid being 2½d. and 2¼d. The Committee adopted the reports, and they came up in the minutes that were presented to the Council.

The Sheepbridge Coal and Iron Company, Limited, Chesterfield, have just received a large order for 24-inch pipes for the Manchester Corporation. They are also about to commence upon an order for 20 to 30 inch pipes for the Derwent Valley Water Board.

GAS, WATER, AND ELECTRICITY AT KENDAL.

The Kendal Town Council, at their last Monthly Meeting, had before them the report of the Manager (Mr. W. Thomson) on the past year's working. It stated that, with regard to the Gas Department, the total revenue amounted to £13,250, the expenditure to £9273, and the gross profit to £3977. After payment of interest, sinking fund, &c., there remained a surplus of £1038, from which was deducted expenditure on new mains, services, and meters, £415, leaving a balance of £623. The reserve fund stands at £5000; and the sinking fund (including debt repaid) at £8940. The total quantity of coal and cannel carbonized was 7180 tons, from which was produced 76¾ million cubic feet of gas. The output showed a decrease of 0·26 per cent., and the income a falling off of £557, as compared with the previous year; the smaller receipts being almost entirely due to a 3d. reduction in the price of gas, making the charge 2s. 8d. per 1000 cubic feet. The total receipts on revenue account from water were £3635, the expenditure £1144, and the gross profit £2491. Deducting interest, sinking fund, &c., there remained a balance of £112. For electricity, the total receipts on revenue account were £906, the expenditure £726, and the gross profit £180. Interest and instalment of loan absorbed £1001. leaving a deficiency of £821.

Alderman Monkhouse said he thought the report was satisfactory in regard to gas. The working of the concern was everything that could be desired; the most was made of everything, and the best results were shown. They had paid the interest on the large capital employed, they had cleared off the cost of the Act, they had paid into the sinking fund £8939, into the reserve fund £5000, and towards the reduction of the rates they had given £4022, including £600 in anticipation of the present accounts. They had been able to build up their works by judicious expenditure of capital which had made them equal to any of a similar size in the kingdom. His ambition was to have gas at 2s. 6d. per 1000 cubic feet as a minimum price; but under existing circumstances, he was bound to say he could not advise a reduction. He paid a tribute to the excellence of the work of Mr. Thomson. Passing to the Water Department, he pointed out that they had a surplus profit of £112. The revenue increased very steadily; and the works were well and carefully managed, and kept in good condition. The Electric Light Department gave him considerable concern. There was a deficiency of £821. This was, of course, carried to the district account, and had to be provided out of the rates, which meant in round figures 4d. in the pound. Fortunately, they were able to give £600 from the gas profits for the reduction of the rate, which on the same basis of reckoning was 3d. in the pound; so that between the two departments the impost on the rates was 1d. in the pound. Great economy was, however, being exercised. It might be asked how it was they did not get more customers for electricity; but he could not explain that. The demand was certainly very limited; and it had been said they should reduce the price in order to induce people to take more. There was much to be said both for and against this; but his idea was that it would make little or no difference. He could not say there would be any less deficiency in the Electricity Department next year. In the figures presented by the Manager, there was nothing allowed for depreciation of plant. Something would have to be done to endeavour to bring the concern into a better financial position.

In conclusion, Alderman Monkhouse moved that, in view of the excellent work done by Mr. Thomson, his salary should be further increased by £25 a year; and after some discussion, this was carried.

ILKESTON CORPORATION GAS DEPARTMENT.

At the Meeting of the Ilkeston Town Council last Tuesday, the following report of Mr. F. C. Humphrys, the Engineer and Manager, regarding the past year's working of the Gas Department was introduced by Alderman F. Beardsley, the Chairman of the Gas Committee, and adopted after some remarks of a congratulatory character had been made upon it.

Owing to bad trade and electricity supply competition, the amount of gas made has been 96,895,600 cubic feet, against 97,402,100 feet—a falling off of 506,500 feet. The income from all sources (including interest on investments) has been £16,267, and the expenditure (including interest paid on overdrafts) £10,499, leaving a balance of £5768, against £6069, or a reduction of about £300. During the year, however, the price of gas has been reduced 2d. per 1000 cubic feet, which makes a difference in the rental of over £800. With the balance in hand, it is proposed to make the usual payments for interest and sinking fund, which will absorb £3284, and for depreciation and suspense account £1283, which, after placing £200 to the reserve, will allow of a contribution of £1000 being made to the general district rate. The capital account has a present balance of £76,265, which reduced by the amount to the credit of the sinking fund (£11,565) leaves the sum of £64,700 as the actual liability of the Corporation on the Gas Department. This works out at the low figure of £660 per million cubic feet made. The number of ordinary consumers at the end of the year was 1151, or a decrease of 34. Slot-meter customers numbered 2994, or an increase of 417. There are 1165 cookers in use—increase of 226.

The principal feature of the year's trading is the fact that the ordinary consumers have fallen off considerably, but that their place has been taken by slot consumers; and though it must cost the department a large outlay to secure this entirely new business, the profit has been not only maintained, but, the reduction in the price of gas taken into account, it has been increased. The whole of the works and plant have been renewed, altered, or repaired where necessary out of revenue, and several improvements introduced. These have all helped the department to produce gas as economically as possible, and to present the Council with a report which must be considered very satisfactory in every respect.

CHEAPER GAS FOR HEREFORD.

In his twenty-first annual report to the Hereford Gas Committee, Mr. William Parlby, the Engineer and Manager, states that the total income of the year to March 25 was £21,896, and the expenditure £16,512—leaving a gross profit of £5383, as against £4931 for the previous year, or an increase of £452. The net profit was £4702, or £433 more; and of this the contributions to sinking fund, &c., absorbed £2435. Under the head of coal there was a saving of £904, though a greater quantity was carbonized. The net rental from ordinary consumers and public lighting (after deducting discounts and irrecoverables) was £14,834, and that from automatic consumers £3196. The net income from residuals was £4352, or about £300 less than in the preceding year. A profit of £329 was made on fittings, as against £214. A sum of £320 was received for the hire of cooking-stoves, and £360 for meters. The quantity of gas made was 134 million cubic feet, or 10,595 feet per ton of coal carbonized; while the leakage and condensation amounted to 10·42 per cent. The Committee, in submitting this report to the Council, recommended that, as from June 24, a reduction should be made of 3d. per 1000 cubic feet in the price of gas supplied to private consumers (bringing the charge to 2s. 9d., subject to the usual discount of 3d.). Also an extra discount of 3d. on gas used for engines (making the net price for this purpose 2s. 3d. per 1000 cubic feet), and an allowance of 5s. per lamp off the cost of public lighting.

After some discussion had taken place with regard to the high percentage of unaccounted-for gas, the Committee's report (including the proposed reductions in price) was agreed to.

OLDBURY GAS DEPARTMENT.

The annual report and statement of accounts for the twelve months ended March 31 in connection with the Oldbury Gas Department, which have just been issued, show that the total amount of loans outstanding at the end of the year was £59,648. Sales of gas realized £13,112, residual products £3899, and gas-fittings £132; and these, with other items, brought the total income up to £17,210. Manufacture of gas cost £8689, distribution £1867, public lighting and repairing £641, rates and taxes £1129, and management expenses £367—making the total expenditure £12,695, and leaving a gross profit of £4514. After making allowance for interest and instalments for the repayment of loans, there remained £963 as the net profit for the year.

When the accounts came before the Council for consideration, a letter was read from Mr. J. W. Wilson, M.P., the Chairman of the Gas Committee, in which he stated that, broadly speaking, they gave away all, or rather more, of the benefit which they got on the coal .n the reduction in price. Indeed, had they foreseen the actual results of the year, it might have been wiser either to have delayed the reduction or to have curtailed the vote to the rates. As to the future, with certain work ahead of them (repairs to gasholder, &c.), it might be necessary, unless manufacturing prospects improved, to seriously consider whether the vote in aid of the rates might not have to be reduced or else the price of gas slightly increased. He did not think, however, that they ought to do more than suggest such a possibility this year, as the Council's estimates had been based on the expectation of receiving £600 from the undertaking. This he hoped the bank account would enable them to pay over early next year; but it would need very strict economy and a curtailing of any unnecessary outlay. Mr. Thomlinson reminded the Council that they reduced the price of gas 1d. per 1000 cubic feet all round last year, and 4d. for motive power, which meant a loss of £700. Mr. Davis remarked that the accounts were satisfactory on the whole, and they had reason to congratulate themselves. They were not looking to any reduction in the amount given to the rates. The report was adopted.

INCREASED LEAKAGE AT BRIGHOUSE.

The report and accounts of the Brighouse Gas-Works for the year to March 31, which were recently presented to the Town Council and adopted, stated that there was a profit on revenue account of £4007. The total quantity of gas made was 186 million cubic feet, an increase of 2½ millions. The gas consumed by the public lamps, public clocks, and on the works was 23,578,100 cubic feet. The unaccounted-for gas was 15,951,000 cubic feet, as against 10,373,917 cubic feet the previous year. The revenue from slot meters was £2306; while residuals had realized £6704 against £8084.

Alderman Healey said he hoped the members would regard the report and accounts as satisfactory. The intention of the Committee was to keep the plant as efficient as possible, for they believed the higher the efficiency the greater would be the ultimate economy. Ever since they had put in inclined retorts—he did not say it was the outcome of that—they had found it necessary to make expensive and also useful renewals of the plant. They would notice that the balance-sheet was not so favourable in all respects as that of last year; but still he regarded it as fairly satisfactory. They had an increased make of practically 2½ million cubic feet, notwithstanding the fact that the Birds Royd works had contributed only 4½ millions. An unsatisfactory feature to him was the quantity of unaccounted-for gas, which had increased by 4½ million feet. They had had some serious leakages; and he noticed in the old gasholder a great many little holes. They did not know to what extent their loss was due to these. Residuals had suffered serious reduction. Compared with the previous year, the receipts from this source were £1380 less. This was chiefly accounted for by the reduced sum they had been able to secure for their coke. The loans repaid amounted to £2577; and for interest they had paid

£3566. Another unsatisfactory feature was the fact that at the end of the financial year there was due to the bank the very large sum of £18,400; and they would notice that during the twelve months they had paid nearly £600 in interest to the bank for overdraft. To him it was very gratifying that there was, under the circumstances, a profit of over £4000.

THE RETIREMENT OF MR. HARRISON VEEVERS.

The retirement of Mr. Harrison Veevers from the position of Engineer and Manager of the Dukinfield Gas-Works (which was referred to in the "JOURNAL" for June 13, pp. 795, 838) was discussed at some length by the Town Council at their last meeting, when the Gas Committee's minutes came up for confirmation.

The Committee recommended that Mr. Veevers should be offered the post of Consulting Engineer at a salary of £150 per annum, and that Mr. William Lindley, the present foreman, should be appointed as Manager in Charge, at a salary of £130. Mr. M'Farlane moved, as an amendment, that the portion of the minute relating to Mr. Veevers should be deleted, and that regarding Mr. Lindley should be referred back for further consideration. He remarked that he did not see that any services Mr. Veevers as Consulting Engineer could render to the Committee could be valued at £150 a year. While he admitted that the works were in a better position than was the case years ago, he did not see how they could benefit by the proposed changes. Mr. Booth pointed out that the minutes of the Committee, with the exception of the salary to be offered, had already been confirmed by the Council; and the only question now before them was the amount of the remuneration Mr. Veevers was to have. Mr. Williams, however, said they had been distinctly told on the previous occasion that whatever the Committee did would come up again for confirmation. The Mayor (Mr. G. H. Kenyon, J.P.) agreed with this, and thought the proper course would be to move that both the resolutions referred to should be sent back to the Committee. Mr. M'Farlane having altered his amendment in accordance with this ruling, the discussion proceeded. Mr. Williams was of opinion that the Council had already enough to do, without adding to their burdens; while Alderman Pickup argued that the time for appointing a Consulting Engineer would be when the Committee wanted one. Mr. Dean said that Mr. Veevers was unable to make the works pay when Manager; and therefore he disagreed with his appointment as Consulting Engineer.

Mr. Booth supported the confirmation of the minutes, on the ground that Mr. Veevers had laboured long and faithfully for the Corporation, and had discharged his duties as Gas Manager in a capable manner. Besides this, if they had a Works Manager, as proposed, they would require a Consulting Engineer; and the arrangement made would mean a saving of something like £100 a year. Mr. Heathcote drew attention to the fact that the matter had been discussed at great length by the Gas Committee, and also by the General Purposes Committee; and as these Committees had all information before them, he felt bound to respect their decision. Alderman Stafford, as a former Chairman of the Gas Committee, said he could speak with greater experience than some members of the Council with regard to Mr. Veevers's services. While he was Chairman (in the years 1897-1900) there was a profit of over £4000. When the works were paying, they could not very well keep the price of gas up. They must give reductions to consumers as soon as they could afford to. The Act of Parliament distinctly laid it down that some relief should be given to consumers whenever there was a profit. He need not tell the older members of the Council that one year there was a profit of £1500; and he would inform the younger ones that in the last four years there had been £4000 paid for the erection of new retorts out of profits. The whole of the works had been modernized; and there was scarcely a brick standing upon the ground that had not been put up within the last ten or twelve years, to the great credit of Mr. Veevers. Those who were members of the Gas Committee knew that Mr. Veevers had built a new retort-house; and there had also been new retort-stacks erected. The present was not the time to change the management, because there were thousands of pounds being spent. In his opinion, the retention of Mr. Veevers as Consulting Engineer was the right and proper course to take; and he would support the passing of the minutes, believing that it would be to the best interests of the ratepayers generally in the town. Mr. Wood, who also supported the recommendation, said the charge for gas in the town—considering the leakages, &c., caused by the coal mines—was considerably less than the average over the country. Some years ago, when coal was extremely scarce and high in price—16s. 6d. a ton—the Committee decided that no advance should be made in the price of gas, which involved a loss of nearly £2000. Had they raised the price, like other places, they would have put £1600 into the coffers of the Gas Committee. Then they had never during the whole of Mr. Veevers's management had what he might term a serious breakdown in connection with the gas supply; never had the gas failed, and never had there been a big accident.

Mr. Bowden (as mover of the confirmation of the minutes) having replied on the discussion, the amendment was defeated by seven votes to ten, and the minutes were passed.

Gas Workers' Wages at Stockport.—The Stockport Gas Committee, after a careful comparison of the working conditions and wages paid in other towns, have come to the conclusion that they cannot accede to the request of their own employees for increased remuneration. The Chairman, Alderman Clarke, said if they gave the men what they asked for, it would make a difference to the financial position of the Corporation of something like £2500 a year; and this would mean 2d. on the rates. They must take into consideration the fact that they were paying the men the standard rate; and he did not see that the poor shopkeepers, who had had a struggle during the last year or two, should be called upon to pay an extra 2d. rate to support the employees of the Gas Department. Oldham paid their gas-workers 6d.; and Stockport paid 5¼d., 5½d., 6d., and 6⅜d.

GAS AND ELECTRICITY AT STAFFORD.

The Past Year's Working.

The report and accounts of the Stafford Gas and Electricity Committee show that for the year to March 31 the output of gas was 189,545,000 cubic feet, and the quantity accounted for 179,169,960 feet—an increase of 5,156,768 feet when compared with the preceding twelve months. The percentage of unaccounted-for gas was 5·47. The quantity of coal (and the coal equivalent of oil and coke used in the manufacture of carburetted water gas) carbonized was 16,227 tons; the cost being £8504, or a decrease of £765. The make of gas per ton amounted to 11,692 cubic feet, of an illuminating power of 16·06 candles. The quantity sold per ton was 10,895 cubic feet. Manufacturing charges were £4555, as compared with £4604; while the cost of distribution was £2850, against £2751. The total working expenses amounted to £9391, as compared with £9393 in 1903-4. The revenue from the sale of gas was £23,595, an increase as compared with the previous year of £748. Residual products brought in a revenue of £7109, as against £7295; but in comparing these figures it must be remembered that the increased quantity of gas produced was manufactured from 16,227 tons of coal, as compared with 16,898 tons in the preceding year—a decrease of no less than 671 tons. Coke and sulphate of ammonia both showed small though satisfactory increases; but the tar market was very depressed, and the receipts from this source have fallen off by about £365. The total revenue for the year was £31,405, and the expenditure £17,896, leaving a gross profit of £13,509, an increase over the previous year's record profit of the substantial sum of £1276. Income-tax paid amounted to £501; interest on capital (including interest on overdraft), to £2865; and repayments in reduction of capital, £4000. Depreciation funds were credited with £1972; and a sum of £100 was added to the bad debts reserve fund. There was thus left a net profit of £4068 as the result of the year's trading. The Committee recommended that the sum of £2000 be transferred, in reduction of rates, to the district fund; that £1500 be carried to the reserve fund; that £50 be given to the Free Library Committee, as in former years; and that the balance be carried forward. The total expenditure upon capital for the gas undertaking remains at the same figure as the previous year—£115,947; and the loans repaid now amount to £54,415—leaving the sum of £61,532 3s. 5d. still owing. With this year's contribution, the total paid out of profits in the reduction of rates to date will amount to £42,325. The analysis prepared by the Engineer and Manager (Mr. Hubert Pooley) states that the make of coke per ton of coal carbonized (less breeze) was 12¼ cwt., of tar 11·5 gallons, and of sulphate of ammonia 27·13 lbs.; the net proceeds of the residuals being equal to 83·6 per cent. of the cost of coal, &c. The wages for carbonizing and for the manufacture of carburetted water gas were £1339, which was 1s. 7·814d. per ton of coal carbonized, and 1·819d. per 1000 cubic feet of gas sold. Repairs and maintenance were heavy; the amount so expended on the works being £2624, on mains and services £1534, and on meters £1045, or 3·562d., 2·083d., and 1·420d. respectively per 1000 feet of gas sold. The net cost of coal (less residuals) per 1000 feet of gas sold was 1·895d.; and the working expenses 12·748d.; making a total of 14·643d. The amount realized for the gas (after deducting £724, the cost of repairs to public lamps, &c.) was 32·030d. per 1000 feet sold, so that there was a profit of 17·387d. To this had to be added the profit on gas-fittings £485, and stove hire (less repairs) £215, making a total profit of 18·338d. per 1000 feet sold.

The total revenue from all sources in the Electricity Department was £3537 (an increase as compared with the preceding year of £658); and the total expenditure was £1409, leaving a gross profit of £2128 as the result of the year's work. Depreciation on the battery and main cables would require £1100 this year, interest on loans amounted to £917, and the instalment of principal in reduction of capital to £992. The Committee therefore decided to ask a contribution from the rates amounting to £992; being the amount of loans repaid for the year. It is particularly gratifying, they remark, to note that the department has earned a profit which exceeds by £218 the sum required to meet interest and sinking fund charges. The total capital expenditure amounts to £31,693, and the loans repaid to £6615, leaving a sum of £25,078 still owing. The quantity of electricity sold to private consumers and for public lighting was 240,325 units, as compared with 180,145 units, or an increase of 60,180 units, equal to quite 30 per cent. The equivalent in 8-candle power lamps connected is 16,538, an increase of 3185.

METROPOLITAN WATER BOARD.

The Recent Shortage of Water—Supply of Water at Fires.

The Ordinary Meeting of the Board was held on Friday—Sir R. M. BEACHCROFT in the chair.

The Finance Committee reported (*inter alia*) that the amount of the duty actually paid by the Board up to date in connection with the vesting of the undertakings of the Metropolitan Water Companies in the Board amounted to £213,294. The Local Government Board had authorized the Board to borrow £209,820, part of this amount. It was decided to make application to them for sanction to the borrowing of £3474, the balance of the amount required for the purpose. The report of the Committee also contained a letter received from the Treasury with regard to the refusal of the Board to pay compensation to the Auditors of the Companies in respect of loss of office. The Board had declined to entertain the question of compensation, and the Auditors accordingly appealed to the Treasury on the subject. In their reply, they said that in the case of appointments requiring periodical renewal it was the invariable practice to award, by way of compensation for loss of office, such a sum as might be required in order to complete full payment of the officer's salary in respect of the period for

which he was last reappointed. If the Auditors had already received full salary for this period, it did not appear to the Treasury that they were entitled to any compensation.

The Law and Parliamentary Committee reported that on the 20th ult. the proceedings taken by the Chiswick Urban District Council, to test the legality of the Board's action in discontinuing the rebate in the West Middlesex district, were heard by Mr. Justice Joyce, who dismissed the action, and held that the Board were entitled to charge the full amount of the water-rate without allowing any rebate. He gave judgment for the amount of the rate claimed by the Board.* They also reported that Mr. Justice Kennedy had given judgment in favour of the Board in the action brought by Messrs. Ridley, Whitley, and Co., who claimed £35,000 in respect of damage done to their works by flood in the Lea Valley.†

The reception of the report of the Works and Stores Committee gave rise to a discussion on the subject of the recent shortage of water in portions of the Lambeth district. Lieut.-Col. Rotton asked for information as to the failure of the supply, and whether or not, as had been charged against the Board by "The Times," any "indifference" had been shown "to the public welfare." Mr. J. H. S. Lawton, the Vice-Chairman of the Committee, said it was known to the Committee that they were very short of filter-beds in the district in question. But the new works for the improvement of the supply in the Lambeth area were being pushed on as quickly as possible. As to the remarks in "The Times," he thought the article was a very intemperate one. The Committee were doing all they could to remedy the defects. The Chairman said he understood that the *gravamen* of the allegations made against the Board was in the first place that no public warning was given; and, in the second, that no temporary stand-pipes were erected. He thought it only right and fair to the Board to say that their Engineer advised the Committee that, in the circumstances, it would have been very inadvisable either to have erected stand-pipes or to have given public warning. The Board might expect criticism at the hands of the newspapers and of the public at large; but he thought it should be fair. Looking at the great difficulties with which they had had to cope in undertaking the management of the large works handed over to them, which were not by any means in a satisfactory state, especially so far as Lambeth was concerned, he hoped that this fair criticism would be accorded to the Board. Mr. J. Lidiard, the representative of the Wandsworth Borough Council, said there was really no stoppage of the supply at all. All the mains were charged during the period of the shortage, and those houses which had taps directly attached to the main were not deprived of water.

The Works and Stores Committee also reported that they had received a letter from the London County Council, in which it was stated that in the early stages of a fire which occurred in Rochester Place, Camden Road, on the morning of the 19th of April, the water supply was very unsatisfactory, and the attention of the turncock was drawn to the interval that elapsed before the supply of water was satisfactory. The Chief Engineer had presented to the Committee a report by the Engineer of the New River district; and the Committee had given instructions for a copy to be sent to the Council, and for their attention to be invited to the portion of it relating to the stoppage of the fire rewards. This report stated that on reaching the fire the turncock found the supply of water inadequate from two hydrants; and he opened up the main valves, giving an adequate supply, under the pressure of the district. The reason the supply was short was that the main had been shut down for the purpose of metering for waste. The turncock was aware of this; and had he been called more promptly by the Fire Brigade no shortage would have resulted. The report also stated that since the stoppage of payment of fire rewards to the firemen, the officials of the Board were seldom called to a fire as promptly as they used to be, and in some cases the men were not called at all. Lieut.-Col. Colville said he thought the matter was of sufficient importance to be inquired into by a Sub-Committee of the Law and Parliamentary Committee. The Board would then have something really definite before them.

A statistical return relating to the supply for the month of May last was submitted. It showed that the total average daily supply was 233,348,000 gallons; that the number of houses, &c., supplied was 1,024,137; and that the total estimated population was 6,720,912. The mean supply per head per day was 34·72 gallons; the figure for the corresponding month of last year being 33·08 gallons. The quantity of water in store in impounding reservoirs at the end of the month amounted to 6912 million gallons. There were 2134 additional supplies laid on; and 9294 yards of new mains were laid. The total number of fires was 236, of which 67 were in the New River district, and 48 and 41 in the West Middlesex and Southwark and Vauxhall districts respectively.

* See "JOURNAL," Vol. XC., p. 977. † *Ibid.*, p. 895.

METROPOLITAN WATER ARBITRATION.

(*Before the Right Hon. Sir* EDWARD FRY, *Sir* HUGH OWEN, G.C.B., *and Sir* JOHN WOLFE-BARRY, K.C.B.)

Monday, July 3.

Since the transfer of the Companies' undertakings to the Water Board, the accounts have been before Mr. Stoneham, the Government Auditor, who disallowed several items, amounting to some thousands of pounds, in the charges of the different Companies against the Board. These cases came before the Court to-day for consideration.

West Middlesex Water Company.

This case had reference to legal expenses incurred by the Company in defending the claim to their reserve fund (amounting to £70,000) to be divided among the shareholders. The Court of Appeal decided that the fund was so divisible; but the House of Lords reversed this decision.

Mr. HALDANE, K.C. (with whom was Mr. KENT), argued that this amount was properly payable as an incident of, and consequential to, the transfer of the undertaking, and therefore ought not to have been disallowed. The Company obtained their maximum dividend of 10 per cent.; and this money would have gone in rebate to the consumers. But as the Company no longer existed, they were not under an obligation to make a rebate.

Mr. FLETCHER MOULTON, K.C., for the Board, contended that the costs of these arbitrations did not belong to the revenue account of the Company at all; that they were not expenses incurred in carrying

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 98.

Issue.	Share.	When ex Dividend.	Dividend or Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
570,000	10	Apl. 13	10½	Alliance & Dublin 10 p.c.	20⅜—21⅜	..	4 17 8
160,000	10	,,	7½	Do. 7 p.c.	14—15	..	5 0 0
200,000	5	May 12	6½	Bombay, Ltd.. . . .	6¼—7	..	4 12 10
140,000	5	,,	6½	Do. New, £4 paid	5—5⅛	..	4 14 6
50,000	10	Mch. 15	14	Bourne-) 10 p.c. . .	29⅜—30⅜	..	4 11 10
251,810	10	,,	7	mouth Gas) B 7 p.c. .	16⅜—17⅜	..	4 0 0
53,200	10	,,	6	and Water) Pref. 6 p.c.	15⅜—16⅜	..	3 12 9
380,000	Stk.	Feb. 24	12	Brentford Consolidated	248—253	..	4 14 10
300,000	,,	,,	9	Do. New . . .	188—193	..	4 13 3
50,000	,,	,,	5	Do. 5 p.c. Pref. .	127—132	..	3 15 9
206,250	,,	June 15	4	Do. 4 p.c. Deb. .	103—106	..	3 15 6
220,000	Stk.	Mch. 15	11	Brighton & Hove Orig.	22⅜—230	..	4 15 8
246,320	,,	,,	8	Do. A. Ord. Stk. .	165—170	..	4 14 2
460,000	20	Mch. 30	10	British	40—41	..	4 17 7
100,000	Stk.	Feb. 24	6	Bromley, Ord. 5 p.c. .	120—125	..	4 16 0
165,700	,,	,,	4½	Do. do. 3½ p.c. .	90—94	..	4 15 9
500,000	10	May 12	7	Buenos Ayres (New) Ltd.	11⅛—12	−¼	5 16 8
250,000	Stk.	June 29	4	Do. 4 p.c. Deb. .	95—97*	..	4 2 6
150,000	20	Mch. 15	8¼	Cagliari, Ltd.	25—27	..	6 2 3
100,000	10	May 31	10	Cape Town & Dis., Ltd.	17—17½	..	5 14 3
100,000	10	Apl. 28	4½	Do. 4½ p c Pref.. .	10—10⅜	+¼	4 5 9
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
50,000	Stk.	June 29	4½	Do. 4½ p.c. Deb. Stk.	100—10.*	..	4 8 3
1,400,000	Stk.	Feb. 24	5⅛	Commercial 4 p.c Stk. .	116—119	+1	4 7 4
560,000	,,	,,	5	Do. 3½ p.c. do. .	112—115	+1	4 6 11
450,000	,,	June 15	3	Do. 3 p.c. Deb. Stk.	85—87	..	3 9 0
800,000	Stk.	,,	6	Continental Union, Ltd.	102—107	−5	5 12 2
200,000	,,	,,	7	Do. 7 p c Pref.	137—142	..	4 18 7
424,070	Stk.	Feb. 18	5½	Derby Con. Stk. . . .	124—126	..	4 7 4
55,000	,,	June 3	4	Do. Deb. Stk. . . .	108—110	..	3 12 9
486,090	10	Jan. 27	11	European, Ltd. . . .	22—23	..	4 15 8
354,060	10	,,	11	Do. £7 10s. paid	15—16	..	5 3 2
15,243,200	Stk.	Feb. 10	4⅜	Gas-) 4 p.c. Ord. . .	98—99	−½	4 8 11
2,600,000	,,	,,	3½	light) 3½ p.c. max. .	92—94	..	3 14 6
3,799,735	,,	,,	4	and) 4 p.c. Con. Pref.	109—111	..	3 12 1
4,193 975	,,	June 15	3	Coke) 3 p.c. Con. Deb.	89—91	..	3 5 11
258,740	Stk.	Mch. 15	5	Hastings & St. L. 3½ p.c.	100—103	..	4 17 1
70,000	10	Apl. 28	11	Hongkong & China, Ltd.	17½—17⅝	..	5 18 11
3,800,000	Stk.	May 12	10	Imperial Continental .	210—213	..	4 13 11
473,600	Stk.	Feb. 10	3½	Do. 3½ p.c. Deb. Red.	96—98	..	3 11 5
175,242	Stk.	Mch. 15	6	Lea Bridge Ord. 5 p.c. .	120—125	..	4 16 0
561,000	Stk.	Feb. 24	10	Liverpool United A . .	224—226	..	4 8 6
718,100	,,	,,	7	Do. do. B . .	166—168	..	4 3 4

Issue.	Share.	When Dividend.	Dividend or Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
306,083	Stk.	June 29	4	L'rpool Unit'd Deb. Stk.	109—111*	..	3 12 1
75,000	5	,,	5	Malta & Medn., Ltd. .	4—4⅛*	..	5 11 1
560,000	100	Apl. 1	5	Met. of) 5 p.c. Deb..	102—104	+1	4 16 2
250,000	100	,,	4½	Melbourne) 4½ p.c. Deb.	102—104	..	4 6 7
541,920	20	May 31	3½	Monte Video, Ltd. . .	11—12	..	5 16 8
1,565,892	Stk.	Feb. 24	4½	Newc'tle & G'tesh'd Con.	108—109	−½	4 4 10
406,125	Stk.	June 29	3½	Do. 3½ p.c. Deb.	92—93*	+½	3 15 3
15,000	10	Feb. 24	10	North Middlesex 10 p.c.	19—20	..	5 0 0
52,940	1.	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	May 12	8	Oriental, Ltd. . . .	145—148	..	5 8 1
600,000	5	Mch. 30	7	Ottoman, Ltd. . . .	6—6¼	..	5 12 0
168,255	Stk.	—	6¼	Plym'th & St'house 5 p.c.	—	..	—
398,490	5	Apl. 28	6	Primitiva Ord. . . .	5¾—6	..	5 0 0
796,980	5	Jan. 27	5	Do. 5 p.c. Pref. .	5—5¼	..	4 15 3
488,900	100	June 1	4	Do. 4 p.c. Deb. .	95—97	..	4 2 6
851,070	10	Apl. 28	7	River Plate Ord. . . .	11¾—12¼	..	5 14 3
300,000	Stk.	June 29	4	Do. 4 p.c. Deb. .	95—97*	..	4 2 6
250,000	10	Apl. 13	7	San Paulo, Ltd. . . .	12⅝—13¼	..	5 5 8
70,000	50	July 1	5	Do. 5 p.c. Deb. .	51—53*	..	4 14 4
135,000	Stk.	Mar. 15	10	Sheffield A	236—238	+1	4 4 0
209,984	,,	,,	10	Do. B	236—238	+1	4 4 0
523,498	,,	,,	10	Do. C	236—238	+1	4 4 0
123,998	Stk.	Mch. 30	5	Shrewsbury Ord. 5 p.c.	107—110	..	4 10 11
70,000	10	May 31	10	South African	15½—16½	..	6 1 3
6,250,000	Stk.	Feb. 10	5⅓	South Met., 4 p.c. Ord.	128—130	..	4 4 7
1,832,700	,,	Jan. 13	3	Do. 3 p.c. Deb.	90—92	..	3 5 3
575,000	Stk.	Feb. 24	5⅓	S'th Suburb'n Ord. 5 p.c.	121—124	..	4 8 9
60,000	,,	,,	5	Do. 5 p.c. Pref. . .	125—130	..	3 16 11
112,533	,,	Jan. 13	5	Do. 5 p.c. Deb. Stk.	130—135	..	3 14 1
502,310	Stk.	May 12	5	Southampton Ord. . .	107—110	..	4 10 11
87.950	,,	—	4	Do. 4 p.c. Deb.	—	..	—
120,000	Stk.	Feb. 24	6¼	Tottenham) A 5 p.c. .	125—128	..	4 17 8
338,120	,,	,,	4¾	and) B 3½ p.c. .	98—101	..	4 14 1
125,000	,,	June 29	4	Edmonton) 4 p.c. Deb.	105—108*	..	3 14 1
182,380	10	June 15	8	Tuscan, Ltd.	9½—10	..	8 0 0
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100—102*	..	4 18 0
30,000	Stk.	Feb. 24	7⅞	Wands-) A 5 p.c. . .	163—168	..	4 12 3
255,636	,,	,,	6¼	worth) B 3½ p.c. . .	135—140	..	4 9 3
60,000	,,	,,	5 17/20	and) C 3½ p.c. . .	114—116	..	4 13 6
57,564	,,	June 29	3	Putney) 3 p.c. Deb. Stk.	80—85*	..	3 10 7
745,872	,,	Mch. 15	5	West Ham 5 p.c. Ord. .	102—104	..	4 16 2
185,000	,,	,,	5	Do. 5 p.c. Pref. . .	123—126	..	3 19 4
193,300	,,	June 29	4	Do. 4 p.c. Deb. Stk.	104—109*	..	3 13 5

Prices marked * are "Ex div."

on the undertaking; and that they must come out of the capital sum awarded for the purchase of the concern.

Sir E. FRY: You say that this could not be in the ordinary course of business?

Mr. FLETCHER MOULTON: Quite so. The Act says: "Until the appointed day each Water Company shall be maintained and carried on by the Company as heretofore in the ordinary course of business." Then it says the accounts are to be made up in the same way.

Mr. FITZGERALD, K.C., followed on the same side, and pointed out that the reserve fund was very largely brought into the arbitration proceedings, and was therefore covered by the award.

Sir E. FRY, in giving judgment, said they were of opinion that the Auditor was right in the course he adopted. These costs related to the taking away from the Company of their whole undertaking, and transferring it to the Water Board. They therefore did not relate to the costs for the maintenance by the Company or to costs for carrying on the ordinary business of the Company. They were costs which could not be in the ordinary course of business, and had nothing to do with maintenance. These were costs which, according to the taxation they ordered, were not to be borne by the Water Board. They were a luxury which the Company had thought fit to indulge in, which exceeded the amount between solicitor and client. For these reasons, the Auditor was right in the decision he gave; and the Court would make a declaration that the costs must be paid by the Company.

East London Water Company.

Mr. BALFOUR BROWNE, K.C. (with whom were Mr. CRIPPS, K.C., and Mr. BARTLEY), dealt with the claims disallowed by the Auditor in this Company's case. The first item was £3090, which the Auditor said ought to have been paid to the City Chamberlain up to June 24, the date of the transfer to the Board. Counsel argued that the obligation to pay to the sinking fund did not arise till the end of the year from the raising of the stock, because until the end of the year they never could say what the average dividend would be. If they took it at half-a-year, and struck an account, then it might seem that there was a large sum to be paid to the City Chamberlain; but at the end of the year it might be all absorbed. The sinking fund was to be paid when the complete year's income was discovered; and the Auditor said it was to be paid from day to day. Next the Auditor objected to pay £17,285, saying that it ought to have gone in the half-yearly account of June, 1904. At the date of the transfer, the Company had £17,285 worth of stores which they had not paid for, which were not included in the award, which had been paid out of revenue, and which the Company claimed to be paid for as they had handed them over to the Board. A gentleman was sent down on behalf of the Board and agreed the figures.

Sir E. FRY: He did not agree to pay?

Mr. BALFOUR BROWNE: I do not say that. If the stores were ours at that day, then they were available to us, and we could have sold them and divided the money. Instead of that, the Company handed them over to the Board.

Sir E. FRY: Do you say it was not part of the undertaking?

Mr. BALFOUR BROWNE: No; it was not in the revenue at all.

Sir E. FRY: How do you know what we valued on?

Mr. BALFOUR BROWNE: I do not know. I know what we claimed on. There has not been a word said about these stores. They are in exactly the same category as other stores that we are handing over, and which the Board are going to pay for outside the award.

Sir E. FRY: They may be paying something which they are not bound to pay.

Mr. BALFOUR BROWNE: They are ordinary stores for the conduct of the business.

Mr. FLETCHER MOULTON: It is a valuation of the whole of the portable property in the undertaking.

Mr. BALFOUR BROWNE: No; it has been agreed as to the stores, and there was not a question between us as to whether it was to be paid. All these stores have been paid for out of revenue. The next item disallowed by the Auditor was for water in store, £21,419. It was not put into any account before the appointed day, because it was unnecessary. Strictly speaking, perhaps, both the sundry stores and the water in store should have been in the accounts, because they were assets. The only reason why the Auditor has refused this claim was because it did not occur in the former accounts; but this was necessary, because it was going to be used. The real question is, Were they fairly there as an asset? Could they have sold this water?

Sir E. FRY: Does not that apply to everything in the undertaking?

Mr. BALFOUR BROWNE: Everything necessary to earn a dividend. We are bound to hand over everything under section 37; but it is to be valued under section 40. I say that this water in store was available for dividend. I was prohibited from selling it; but it was not to be included in your award. We say that the Auditor was wrong as to the sinking fund of £3000; that we are entitled to the £17,285 as an asset available for dividend on the appointed day; and also for the value of the water in store, £21,000 odd.

Mr. *W. B. Bryan*, Engineer to the Company, and Mr. *John Gaine*, President of the Institute of Chartered Accountants of England and Wales, proved that the accounts were made up as in previous years.

After arguments by Mr. FLETCHER MOULTON and Mr. A. B. SHAW had been heard on behalf of the Board, Mr. BALFOUR BROWNE replied for the Company.

Lambeth and Southwark and Vauxhall Companies.

Mr. CRIPPS, speaking on behalf of the Lambeth Water Company, said the same three questions arose in that case for the decision of the Court.

Mr. BALFOUR BROWNE added that, so far as the Southwark and Vauxhall Company were concerned, their case was also identical with that of the East London Company in regard to the two points of the sinking fund and the stores.

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SOLE MAKERS—

C. & W. WALKER, LTD.,

Midland Iron Works:
DONNINGTON, NEWPORT, SALOP.

London Office:
110, CANNON STREET, E.C.

Sir E. FRY, in giving his decision, held, with regard to the sinking fund, that inasmuch as the Company's Act required the sum to be ascertainable and paid at the end of each year, the time had not arrived for the payment to be made; and therefore the contention of the Auditor was wrong. Not only was the sum not ascertainable until the end of the year, but it was not payable until the end of the year. They could not apportion a sum which had never come into existence at all. With regard to the other two points, as to water in store and stores, he decided that these were a part of the undertaking really to be handed over as a going concern, and that the Company could not denude the concern of these stores. Could the value of the stores and of the water be brought into account? In other words, could the Company, for the purpose of paying an immediate dividend, have denuded themselves of all these stores? They absolutely could not have brought them in. He thought that the Auditor, therefore, was quite right in both these respects.

No order was made as to costs.

The same decision applied to the Southwark and Vauxhall Company and the Lambeth Company.

Tuesday, July 4.

When the proceedings were resumed to-day, it was announced that the parties had come to an agreement, and this terminated the long inquiry of about sixty days in Court, and several days in Chambers.

Mr. FLETCHER MOULTON said they had agreed to follow the lines of the decision in the East London case on the previous day, and apply them to the Southwark and Vauxhall and Lambeth Companies.

Mr. CRIPPS said, as to the further awards regarding costs, they had agreed the liquidation costs in the case of the East London Company at £6022; the Grand Junction Company, £5480; and the Southwark and Vauxhall Company, £4000. They proposed to make these payments through an order of the Court.

Sir E. FRY said they could not separate without expressing their thanks to Counsel on both sides for their great assistance, which had enabled the proceedings to be conducted in a pleasant manner.

Mr. FLETCHER MOULTON said the Board desired to express their great gratitude to the tribunal for the patience, skill, and rapidity with which they had dealt with all these complicated questions. The decisions, taken as a whole, had given the most complete satisfaction to all parties. They were given on one of the most complicated problems that had ever been submitted to any Court.

Mr. DU CANE, on behalf of the Companies, expressed hearty concurrence with Mr. Moulton's sentiments.

Messrs. F. C. Sugden and Co. have had orders placed with them for semi-deep regenerator settings by the Abersychan Gas Company and the Knighton Gas Company; and for shallow regenerators by the Buckley Gas Company.

PROGRESS OF THE PLYMOUTH WATER-WORKS.

Statistics of the Supply.

The members of the Plymouth Corporation recently paid their annual visit to the water-works on the occasion of what is known as the "Fishing Feast." After drinking the time-honoured toasts to "The pious memory of Sir Francis Drake" and "May the descendants of him who brought us water never want wine," the party sat down to luncheon. In the course of the proceedings, Mr. A. R. Debnam, the Chairman of the Water Committee, made a speech on the present condition of the undertaking. He thought it exceedingly satisfactory to know that the recent test had shown that the leat might be used as a secondary and subsidiary means of supply, and that in case of emergency or extraordinary demand it could be resorted to for the supply of the whole town for at least a limited period. The Committee were now devoting attention to the prevention of waste of water. This might appear to be unnecessary, in view of the provision they had made for storage; but, as a matter of fact, it was very necessary if they intended to avoid grave difficulties in the future. The Burrator reservoir was built upon the estimate of a consumption of 35 gallons per head per day. In 1901-2, the domestic supply amounted to 3,685,000 gallons per day, which was equivalent to about 34 gallons. Last year the domestic consumption was 3,182,000 gallons per day, or, allowing for the increase of population, 28 gallons per head. On the other hand, the supplies in bulk and for trade purposes had increased. In 1891 these amounted to 1,351,000 gallons per day; in 1901-2 to 2,040,000 gallons; and in 1904-5, to 2,105,000 gallons. The total consumption per head in 1891 was 58 gallons; in 1901-2, 46 gallons; and in 1904-5, 40 gallons—a reduction in the last four years of 6 gallons per head, notwithstanding the increased trade supply. The saving on an average population of 113,631 had been 896,000 gallons per day. If this water had been sold at 6d. per 1000 gallons, the price charged to customers outside the borough, it would represent a value of £6351 per annum. If the rate per head in 1901-2 had been maintained, the total consumption for all purposes at present would be 6,400,000 gallons daily, instead of 5,723,000 gallons as at present; and it would be necessary to expend from £30,000 to £60,000 in providing lines of pipes. The number of new supplies put in during the past year had not been so satisfactory as formerly; the total being 845 as against 958 in the previous year. The total number of supplies at present was about 19,400. There had been a gratifying increase in the income in recent years. In 1896, it amounted to £18,947; in 1899, to £23,299; in 1903, to £30,176; and in the year 1904-5, to £30,868. The cost of administration, excluding capital charges, rates, taxes, insurance, and private works, was £5696 in 1896 (including private works), £6345 in 1899, and £6094 in 1904-5; so that while the income was increasing the expenditure on such things as the Committee could control was going down.

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

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W. H. PEARSON, Junr., Deputy-Chairman.
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WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	KINGSTON, PA.	125,000	STRETFORD	500,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	PETERBOROUGH, ONT.	250,000	OLDBURY	300,000
COLCHESTER	300,000	WILKESBARRE, PA.	750,000	TODMORDEN	500,000
BIRKENHEAD	2,250,000	ST. CATHERINES (2nd Cont.)	250,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
SWINDON (New Swindon Gas Co.)	120,000	BUFFALO, N.Y.	2,000,000	YORK (Second Contract)	750,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	WINNIPEG, MAN.	500,000	ROCHESTER (Second Contract)	500,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	COLCHESTER (Second Contract)	300,000	NEWPORT (MON.)	250,000
HALIFAX	1,000,000	YORK	750,000	TOKIO, JAPAN	1,000,000
TORONTO	250,000	ROCHESTER	500,000	PERNAMBUCO (Brazil)	125,000
OTTAWA	250,000	KINGSTON, ONT.	300,000	MALTON	150,000
LINDSAY (Remodelled)	125,000	CRYSTAL PALACE DISTRICT	2,000,000	DULUTH, MINN. (2nd Cont.)	300,000
MONTREAL	500,000	DULUTH, MINN.	300,000	BROCKVILLE (ONT.)	250,000
TORONTO (Second Contract Remodelled)	2,000,000	CATERHAM	150,000	SMETHWICK	500,000
BELLEVILLE	250,000	LEICESTER	2,000,000	GRAVESEND	300,000
OTTAWA (Second Contract).	250,000	ENSCHEDE (HOLLAND)	150,000	NEWPORT MON. (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000	BUENOS AYRES (RIVER PLATE CO.)	700,000	TORONTO (Third Contract)	750,000
		BURNLEY	1,500,000	TORONTO (Fourth Contract)	1,000,000
		KINGSTON-ON-THAMES	1,750,000	MONTREAL, ONT. (2nd Cont.	1,800,000
		ACCRINGTON.	500,000	HAMILTON, ONT.	400,000

LEEDS, 1,800,000 C. Ft. LEICESTER (2nd Cont.), 1,000,000 C. Ft. NEWCASTLE-ON-TYNE, 1,800,000 C. Ft

AND IN ADDITION, 7,900,000 CUBIC FEET DAILY; also Coal-Gas Plants at NELSON B.C. CHATHAM, BERLIN, NAPANEE, OWEN SOUND, CALGARY, and WINNIPEG

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

I have received from Mr. R. S. Carlow, the Secretary of the North British Association of Gas Managers, the programme, which was adjusted in Glasgow on Monday last, of the forty-fourth annual meeting of the Association, which is to be held in St. Andrews on the 20th and 21st inst. Three papers are to be read—by Messrs. A. Yuill, of Dundee, W. B. M'Lusky, of Perth, and Allan Reid, of Brechin. All of them deal with questions of administration in connection with gas undertakings; technical subjects not being raised. The President—Mr. J. W. Carmichael, of Barrhead—is a west country manager; but it will be observed that all the readers of papers hail from the eastern side, in which fact there may be found a presentiment that the gathering will be largely an east country one. That this is probable may also be inferred from the difficulty there is in securing accommodation in St. Andrews. At this season of the year the hotels are full of the devotees of the game of golf, and I understand the hotel keepers will not book apartments forward. Of course, Dundee is not far off, and any who may be left out in the cold at St. Andrews will easily find accommodation there.

The Cleaning and Lighting Committee of the Edinburgh Town Council on Monday re-committed a report by a Sub-Committee, which recommended that 1950 of the existing gas-lamps in the streets should be fitted with incandescent burners, and that the further consideration of the scheme of lighting the streets by electricity should be taken up. It appears that a difference of opinion has arisen between the Committees as to the charge for electric arc lamps. The Electric Lighting Committee had stated their willingness to provide new lamps at £9 10s. a year; their understanding being that existing lamps would continue to be paid for at the rate of £10 15s. a year. The Cleaning and Lighting Committee were of opinion that old and new lamps alike were to be charged £9 10s.; and it was with a view to overcoming the difference that the report was re-committed.

The shareholders of the Brechin Gaslight Company met on Monday, under the chairmanship of Mr. J. Guthrie, who said that the Directors were able to report considerable progress in the course of the past year. In spite of keen competition, and the fact that the streets of the town are now entirely lighted by electricity, the Company had touched high-water mark, having made more gas than ever before in any one year. The Company desired the public to share in their prosperity; and while fixing the dividend at £1 6s. 6d. per share, they proposed to reduce the price of gas for cooking, heating, and power purposes from 3s. 9d. to 3s. 6d. per 1000 cubic feet—the price for lighting to remain at 4s. 4d. The report of the Directors was adopted. A year ago the price of gas was reduced by 2d. per 1000 cubic feet for lighting, and by 3d. for other purposes.

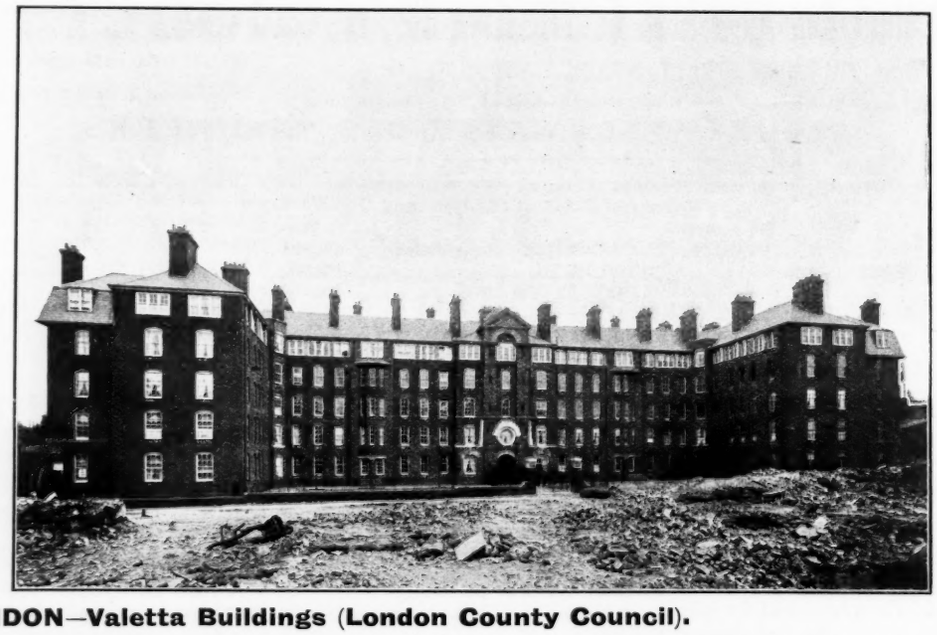
During a thunderstorm on the afternoon of Sunday last, lightning entered a house at Stonehaven, and, getting on to the gas-piping, fused the pipe in the lavatory and set fire to the gas. The only occupant of the house at the time was an invalid child; but neighbours observing that something had happened went in and turned the gas off at the meter, thereby preventing what would probably have been a serious occurrence.

The Aberdeen Town Council on Monday discussed the laying of a gas-main in Balnagarh Road, on the south side of the River Dee. The proprietor of a house had asked for a supply of gas; and the Gas and Electricity Committee, considering that the house is about 300 yards from the present end of the main, agreed to give the supply on the condition that the applicant should pay £25 towards the cost of the work, which is estimated at £45, and that the pipes should remain the property of the Corporation. The Council, by 22 votes to 3, adopted the arrangement proposed by the Committee.

The Coupar Angus Gas Company, notwithstanding heavy outlays upon extensions, last year earned a satisfactory profit. They have declared a dividend of 6 per cent., and have reduced the price of gas 2½d. per 1000 cubic feet. An honorarium of five guineas has been voted to the Manager, Mr. W. F. Vernon. The Blairgowrie Gas Company have paid a dividend of 5 per cent.—the same as last year. The shareholders of the Kinross and Milnathort Gaslight Company, at their annual meeting on Monday, in addition to declaring the dividend intimated last week, reduced the price of gas for all purposes by 2½d. per 1000 cubic feet; making it 4s. 4½d. for ordinary purposes, and 4s. 2d. for cooking and power purposes. The Pittenweem Gas Company have paid a dividend of 10 per cent., the same as a year ago, have applied £100 towards the reduction of a loan of £300, and have carried forward £25. During the past year, it is reported, the Markinch Gas Company had an increased output of gas to the amount of 15½ per cent., and an increased sale equal to 18 per cent. The Muirkirk Gas Company, out of a profit of £197, have paid a dividend at the rate of 7½ per cent., have carried forward £32, and have reduced the price of gas from 4s. 7d. to 4s. 2d. per 1000 cubic feet. The annual meeting of the shareholders of the Lasswade and Bonnyrigg Gaslight Company, Limited, was held on Tuesday, the 27th ult., when a very favourable report upon the past year's working was submitted. The sale of gas had increased by 477,000 cubic feet. It was agreed to reduce the price by 2½d. per 1000 cubic feet, making it 3s. 11½d. This is the third reduction during the past three years. A bonus was voted to the Manager—Mr. William Brown—with a substantial addition to his salary for the ensuing year.

The report of the Water Committee of the Corporation of Glasgow, which has just been issued, sets forth that the ordinary revenue during the year ending the 31st of May was £234,557; from hydraulic works, £12,032; and from river supply works, £2665—a total of £249,254. There was a credit balance from the previous year of £16,333, which raised the revenue to £265,587. The ordinary expenditure, including annuities, was £177,760; for hydraulic power, £9428; and for river supply works, £3575—a total of £190,763, leaving a

INSTALLATIONS.



LONDON—Valetta Buildings (London County Council).

FITTED UP BY RICHMOND'S

FOR THE GAS LIGHT AND COKE COMPANY, LONDON.

ADVERTISEMENT OF THE RICHMOND GAS STOVE & METER CO., LTD. LONDON: 132, QUEEN VICTORIA STREET, E.C. WORKS & OFFICES: WARRINGTON & STRATFORD.

balance of £74,824. Of this sum, £62,271 has been placed to sinking fund account, and £12,553 has been carried forward. The revenue was greater than that of the preceding year by £3153, and the expenditure was greater by £3542. The amount expended on new works during the year was £25,676.

The annual inspection of the Glasgow Corporation water-works took place on Thursday and Friday last week. The event is one which at all times bulks largely in the municipal calendar; but this year there was more than the usual interest taken in it, in respect that this is the jubilee year of the acquisition of the water undertaking by the Corporation. It is also the last year of office of Lord Provost Sir John Ure Primrose; and the "water trip," as it is called, is, by tradition, the occasion upon which the new Lord Provost is informally nominated. The party, to the number of about eighty, took train to Kingshouse, on the Callander and Oban Railway, and drove from thence to Loch Doine, from which it is expected that in the future the Loch Katrine water supply will be augmented. Returning to Kingshouse, they entrained for Callander, and drove from there to the Trossachs Hotel, where they put up for the night. After dinner, the informal meeting of the Council was held, with Bailie George Mitchell, the Senior Magistrate, in the chair. Two names were submitted to the meeting as candidates for the provostship—being those of Preceptor R. M. Mitchell and Mr. Bilsland. A vote was taken by ballot; and it was found that Mr. Mitchell had received 31 votes and Mr. Bilsland 26. Neither of these gentlemen attended the meeting. The evening was spent in a social way. Next day the party inspected the outlet works at Loch Katrine, and then proceeded, by boat and coach, to Inversnaid, where they dined, journeying home in the evening by boat upon Loch Lomond and by train from Balloch. At the dinner, the Lord Provost, in reply to the toast of "The Corporation of Glasgow," said there was no better ornament in the municipal history of their city than the fact that a Highland loch, unparalleled for its beauty, had been made a tributary to the wants of a great city, and to-day, with fuller potency than ever, dispensed the water of life to the teeming multitude of commercial Glasgow. They must ever remember Robert Stewart, who, through good and ill report, stood to his convictions regarding the water supply of Glasgow, and, moreover, lived to see them triumphant. The city to-day was the possessor of a rich inheritance, which the individual effort and courage of a solitary man had brought about. Mr. Calderwood, the Convener, replied to the toast of "The Water Committee." He said that in 1855, when the water undertaking became Corporation property, the water supplied amounted to 14,000,000 gallons per day; this year it was 63,622,793 gallons per day. In 1855, the revenue was £52,983; now it was £234,557. The domestic rate in 1855 was 1s. 2d. in the pound; now it was 5d. and 10d. During the whole of the inspection the most favourable weather was experienced.

The estimates for the current year of the Dundee Water Commission were considered last week. The gross estimated revenue was £51,516, and the expenditure £51,410. The estimates were approved; and it was resolved to fix the domestic rate at 9d. in the pound, the public rate at 1d., and the special rates in terms of the printed table of rates.

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *July* 8.

The market has been quiet, and prices again show a slight decline; the closing quotations being £12 7s. 6d. per ton f.o.b. Hull, and £12 10s. to £12 11s. 3d. per ton f.o.b. Liverpool and Leith. The shipments in June were about 700 tons in excess of those in June, 1904, and there has been no accumulation of stock in the hands of makers; but the Continent remains quite off the market, and demand from other quarters is barely sufficient to absorb the moderate summer production. Although there is a fair amount of inquiry for forward delivery, and although makers have moderated their ideas of value, very little first-hand business has transpired. Buyers still look for a lower level of prices, and Continental manufacturers are showing a disposition to meet them.

Nitrate of Soda.

This article is very quiet in all positions, and spot prices are 10s. 6d. to 10s. 9d. per cwt., for ordinary and refined qualities respectively.

Tar Products. LONDON, *July* 8.

Business has been fairly brisk during the past week; and prices as a rule have been well maintained. The principal feature in the market for benzol has been a strong demand for 90 per cent., which is evidently very scarce so far as prompt delivery is concerned. Business has been done in London at 9½d. for prompt; while it is reported that the same price was declined for August-December by one of the largest producers. In the North, however, business has been done at 9d. per gallon in several instances; and it would seem that there are still sellers at this price for early delivery, In 50-90 per cent., the demand has been principally for home consumption, and 8½d. has again been paid for July-August. The position of toluol is very peculiar. It is reported that in one instance as much as 8½d. has been paid for July; while against this business is reported in another quarter at 8d. for July-September inclusive. The demand for solvent naphtha continues fairly good; and prices are well maintained. There is really nothing fresh to report in anthracene, although there are rumours of offers having been made at very low prices by Continental consumers which were declined by makers here. Carbolic acid is decidedly quiet. Business has been done at 1s. 9d. and 1s. 9¼d. for early delivery, less the customary discount. In crystals, there is still a fairly good demand, especially for 39-40 per cent., in which business has been done at 6¼d. for delivery over the next three months. The principal producers of creosote still maintain their quotations. There does not, however, appear to be much business doing; while the small quantities of salty oil which are being offered do not find a ready

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market. In Yorkshire, 1⅜d. has again been paid for some parcels for early delivery; but very low prices have been accepted in the Liverpool district. Pitch is decidedly quiet, and business is reported both in South Wales and in Belgium at very low prices. There have been one or two inquiries during the past week from the North of France; but it would seem that this district is being principally supplied from foreign sources. So far as the South Wales consumers are concerned, they are still open to purchase for August-December; but the prices offered are so very low that they do not seem likely to be accepted, and as the briquette market is decidedly quiet, it is possible that consumers will not be in any hurry to purchase for forward delivery. There is not much offering on the East Coast. One or two small parcels are, however, reported to have been sold at rather low prices; while in Lancashire the small parcels which are being offered for prompt shipment do not find a ready market.

The average values during the week were: Tar, 16s. to 21s. 6d. Pitch, London, 28s. 6d. to 29s.; east coast, 28s. to 28s. 6d.; west coast, 26s. 6d. to 27s. 6d. **Benzol, 90 per cent.**, 9d. to 9½d.; **50-90 per cent.**, 8¼d. **Toluol**, 8d. to 8¼d. **Crude naphtha**, 3¼d. to 3⅜d.; **solvent naphtha**, 8¼d. to 8½d.; **heavy naphtha**, 10d. to 11d. **Creosote, London**, 1⅛d. to 1⅜d.; North, 1¼d. to 1⅜d. **Heavy oils**, 2d. to 2 1/16d. **Carbolic acid, 60 per cent.**, 1s. 9d. to 1s. 9½d. **Refined naphthalene**, £4 to £8; salts, 12s. 6d. to 14s. **Anthracene**, "A" quality, 1¼d. to 1⅜d.; "B" quality, unsaleable.

Sulphate of Ammonia.

The market has been decidedly easier during the past week, and there is really very little business doing. The nominal quotation at Beckton is £12 12s. 6d. for prompt shipment; but at this price there does not seem much chance of business at present. The South Metropolitan Company are quoting £12 12s. 6d. to £12 15s. on their own terms; but these offers do not tempt buyers to purchase. There does not appear to be any actual business doing in Leith; but quotations are from £12 10s. to £12 11s. 3d. for immediate shipment. In Hull, the market is very quiet. There are sellers at £12 8s. 9d. for prompt; but the actual market value is really not more than £12 7s. 6d. for July to August shipment. There is very little business reported at Liverpool, and prices are, if anything, decidedly easier all round.

COAL TRADE REPORTS.

Lancashire Coal Trade.

There is no alteration to report in the Lancashire coal trade. With the exception of all kinds of engine fuel, there is little demand. House coal is stagnant, and will remain so under present weather conditions. Gas coal and cannel is going out steadily under the new contracts. For coke, there is a fair inquiry. Shipping coal is only in moderate demand. Many of the collieries are only working three and four days per week. This fact has accentuated the dissatisfaction felt by many miners at the smallness of their remuneration for "bad" places, and representations are being made for some increased consideration on the part of employers. The help of the Federation is being sought in the matter; but under the present conditions of the coal trade, it seems improbable that much notice will be taken of the men's disaffection. Our last list of quotations holds good.

Northern Coal Trade.

There is a slightly better demand for some classes of coal, and the shipments to ports such as Hamburg continue very heavy. Best Northumbrian steams are quiet at from 9s. 3d. to 9s. 4½d. per ton f.o.b., second-class steams are 8s. 3d. to 8s. 6d., and steam smalls are firm and rather scarce at from 4s. 9d. to 5s. 6d. In the gas coal trade, there is still a very low delivery compared to that in the winter. But it is beginning to show some slight enlargement; and in the course of a month or so, the surplus coal on the market will be reduced greatly. Fair Durham gas coals vary from 7s. 9d. to 8s. 3d. per ton f.o.b.; but for one or two classes of coal a higher price is asked—the collieries being well placed with contracts. No new sales of any moment are reported in the last few days, though one or two lots for shipment have been sold at about the prices above quoted. The coke trade is steady. Good gas coke for export is less plentiful, so that the prices may be said to be steady, as we last quoted them.

Scotch Coal Trade.

Trade continues to be very disappointing to coalowners, both as to its volume and the profit upon it. There is widespread complaint that collieries are being worked at a loss. Wages are already at their minimum under the conciliation scheme, and therefore relief can only come by an improvement in prices. It is feared that, in the meantime, a good many men will be thrown idle, with a view to reducing the output. The prices quoted are: Main 7s. 3d. to 7s. 6d. per ton f.o.b. Glasgow, ell 8s. to 8s. 9d., and splint 8s. 3d. to 8s. 6d. The shipments for the week amounted to 238,040 tons—a decrease of 26,280 tons upon the preceding week, but an increase of 3548 tons upon the corresponding week of last year. For the year to date, the total shipments have been 5,917,306 tons—an increase of 398,037 tons upon the same period of 1904.

Portadown and Banbridge Water Board.—In view of the fact that the Local Government Board have granted the application of the Portadown and Banbridge Water Board for permission to raise a loan of £70,000 for the purpose of acquiring lands and providing a water scheme for the towns, a contract has been entered into by the Water Board for a loan to them of £50,000. A resolution has been adopted giving the option as to the residue of £70,000 to complete the whole loan on the terms that the loans would be secured by mortgage on the rates of the towns of Portadown and Banbridge, and by the creation of a sinking fund, which will be annually invested in trustee stocks, in accordance with the requirements of the Act of Parliament. A sum of £54,000 has already been subscribed

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BIRMINGHAM, AND BELFAST.

Electric Light Loan Refused for Wisbech.—It is stated that the Local Government Board have decided not to grant the application of the Wisbech Corporation for power to raise a loan of £25,000 for the purpose of carrying out an electric light scheme. Though the scheme was adopted by the Corporation, strenuous opposition to the suggested outlay was forthcoming from a strong minority of the Council; and these opponents were supported by a large body of the ratepayers when the Inspector held his public inquiry last September. An extensively signed petition against the proposed outlay was also presented; and it is doubtless in deference to the strong opposition aroused that the application has been refused.

The Water-Gas Plant for Devonport.—The question of the provision of water-gas plant was again under the consideration of the Devonport Gas Committee last Friday. It was decided to recommend the Council to accept the tender of Messrs. Cutler and Sons for the installation of their system. The amount of the original tender for the plant and oil-tank was £4875; but the scheme now proposed will cost upwards of £8000, and will include a much larger tank than was originally proposed, steel buildings for housing the plant, and the complete equipment of the system. With the foundations, the total cost of the installation will be about £8500. It is proposed to have the work completed and the plant in operation by November next.

Cost of Gas and Electric Street Lighting at Hartlepool.—The Hartlepool Town Council have been favoured by Alderman Harrison with particulars regarding the present cost of street lighting by electricity as compared with the previous cost of gas lighting. Six districts of the town, he said, were now lighted by electricity; and the cost of this lighting had during the past year been £768. Gas lighting in these districts for the previous year cost £247; so that the extra charge to the ratepayers for electric lighting was £521. The candle power was, however, now nearly 66,000, as compared with 30,500 when gas was used. Mr. Foxton remarked that electricity had proved very expensive; costing them nearly three times what they previously paid for gas. He did not think electric light worth this difference, and suggested that, though Hartlepool might not immediately follow the example of many towns that had gone back to an improved system of gas lighting, they might at all events not lose sight of this course.

A Coal-Buying Committee for Cardiff.—The Cardiff County Council have unanimously adopted a resolution "that in future the purchases and delivery of coal for the requirements of the Corporation be controlled by a Buying Committee, with the view of centralizing the purchases, and thereby effecting an economy in prices." The mover, Mr. Vivian, pointed out that the coal requirements of the Council amounted to between 20,000 and 25,000 tons per annum, and the prices varied considerably. At present the quantity supplied to the several Committees was in small lots varying from 1 to 500 tons; and each department made up its own arrangements. But no special study was made of the market, and no inducement offered to get preferential treatment. The Committee should, he said, be composed of members of the Council acquainted with the coal trade and the state of the coal markets; and there should be representatives on it from all the departments using coal. The question of the haulage being done by the Corporation should also be considered.

Claim Regarding a Southampton Gas Explosion.—The Works Committee of the Southampton Town Council report the receipt of a letter from the Solicitors to the Gas Company, respecting the damage to gas-mains in Mount Street and Oak Road, Northam, alleged to have been caused by the use of the steam-roller, and stating that unless they received within seven days an undertaking from the Corporation not to use a steam-roller on unsuitable roads under which the Company's mains and pipes were laid, and also the payment of the damages claimed, they would apply as they might be advised by Counsel to the Court for an injunction restricting the Corporation in their use of the steam-roller and for the damages claimed. It was resolved that the Committee considered the request an unreasonable one, and could not grant the undertaking asked for. Messrs. Taylor and Sons, Solicitors, wrote claiming on behalf of the Northam Conservative Club a sum of £552 2s. 6d., on behalf of Mr. P. F. Stutchbury £170 9s., and on behalf of Mr. A. W. Ponsford £4 11s., for loss sustained by destruction of, and damage to, their respective properties on May 1 last, by an explosion of gas caused by gas escaping from a main, alleged to have been broken by one of the steam-rollers belonging to the Corporation. It was resolved, without prejudice, to defer the consideration of the claims until the next meeting, and that in the meantime the Borough Engineer be directed to report. The explosion was referred to by Captain A. J. Corse Scott, J.P., in his speech to the shareholders of the Gas Company at their last meeting ("JOURNAL," May 9, p. 384).

A Challenge at Newquay.—Mr. L. Fletcher, the General Manager of the Welsbach Incandescent Gaslight Company, has written to the "Newquay Chronicle" expressing the willingness of his Company to take up a challenge regarding the relative cost of gas and electricity which was thrown out by Messrs. Foote and Milne in a communication contained in a previous issue of the same paper. He remarks that his Company have challenged electric lighting undertakings so frequently without finding anyone willing to take up the gauntlet, that it is positively refreshing to at last come across someone who has apparently sufficient confidence in that method of illumination to back it. The conditions set forth by Mr. Fletcher are as follows: "We are willing to instal, free of charge, through our agents, the Gas Company, a given house in Newquay throughout with Welsbach-Kern burners and mantles, if Messrs. Foote and Co. will instal a similar house on the same terms with electric light. The illuminating power to be equal, light for light, throughout twelve months, and to be the subject of four independent expert tests during that period. Gas to be charged at 5s. per 1000 cubic feet, and current at 4d. per unit. And if at the end of the year the result does not prove that the Welsbach light for our house, allowing for mantle renewals at full prices, has cost less than one-fourth of the electric lighting account for their house, we will pay for their installation, and subscribe 20 guineas to the local hospital. If the contrary, they are to pay for ours, and put up the like amount for the hospital." It will be interesting to see if this offer is accepted by the champions of electricity.

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Local Government Board and Economical Lighting.—Electric lighting was the method of illumination favoured by the Hackney Guardians for the Children's Homes at Ongar; but the Local Government Board have intimated that they are not satisfied that it is necessary in the interests of economy to substitute electricity for gas. The first estimated expenditure of the ratepayers' money for this purpose was £4500; and then it was reduced by £1000. But the Local Government Board will not have it.

Gas Supply of Silsden.—The Silsden (Yorks.) Urban District Council have had an encouraging first experience in the management of their gas supply. New works were opened in May last year, and the report of a period of eleven months, submitted at a recent meeting of the Council, showed that a gross profit of £928, or a net profit of £332 after meeting all fixed charges, had been made. The Council were previously one of the largest consumers supplied by the Kildwick Gas Company. It was decided to increase the salary of the Gas Manager, Mr. H. Butterfield (formerly of Bingley).

Birmingham Gas-Fitters' Association.—As the outcome of the agitation that has been taking place in Birmingham with reference to the Corporation undertaking business in gas-fitting, it has been resolved to form the Birmingham and District Master Gas-Fitters' Association. The Secretary makes the following statement of the objects aimed at: "(1) We do not desire to reduce the consumption of gas, but rather to increase its sales; (2) the Gas Department to hire out cookers as now, and fix same; (3) that penny-in-the-slot fittings, &c., should be supplied as usual, and the fitting of same handed over to the private fitters, as used to be done; (4) that the department should not sell or fix gas-fittings, this part of the business being left entirely to the private trader; (5) the idea of boycotting has not emanated with us, neither have we any sympathy with it. We are anxious for the whole question to be thoroughly understood and discussed, and are confident if the matter is taken up in this spirit we shall be able to prove to the Gas Department the injustice which we have to contend with."

Price of Gas for Power at West Bromwich.—When the recommendation of the West Bromwich Gas Committee to reduce the price of gas for manufacturing and power purposes (*ante*, p. 53) came before the Town Council last Wednesday, Mr. J. E. Wilson, the Chairman, said the Committee could not see their way clear to make any elaborate reduction; but they were doing what they could to encourage the consumption during the day. They also hoped by this concession to be able to meet some of the competition so very near their doors. As the Council knew, there had been great changes made in regard to gas for motive power during the past year; and they wanted if possible to keep the new gas out of the town. He did not know whether they would succeed; but the Committee felt that the reduced prices they had scheduled would meet the question for a time at any rate. Mr. Holland protested against the reduced prices proposed, and contended that they would be selling gas at less than cost price. He moved that the matter be referred back to the Committee. Mr. Wilson replied that during the coming year the gas would cost them 10d. per 1000 cubic feet in the holder. All the other expenditure up to 2s. 1½d. was for interest, sinking fund, and general charges. If they could sell a few million feet of gas during the day, when the plant would be otherwise idle, all they obtained over 10d. per 1000 cubic feet would be practically profit. The recommendation as to the reduced charges was carried.

Mond Gas for Boiler-Firing.—Further reference to this subject, alluded to last week (p. 55), was made at the meeting of the South Staffordshire Mines Drainage Commissioners on Wednesday. Mr. G. Macpherson, who presided, remarked, in regard to the Tipton district engineering scheme, that it was satisfactory to learn that the new Mond gas-engine at Park Lane was started for good on the 14th ult., and had worked constantly ever since. He said it was impossible to state at present the exact cost of running the engine, but there was no doubt it was working on most economical lines. It was certainly an immense improvement on the old steam-engine and boilers. Its working had proved conclusively that Mond gas could be economically applied for pumping purposes; and so satisfactory was the working of this first installation, that it was thought the other five engines comprised in the scheme might be safely proceeded with. Alderman R. Williams remarked that the experiments which the Commissioners were making with Mond gas were of far-reaching importance. There seemed to be no doubt respecting its efficiency; but in regard to the firing of boilers he should like to know how it compared with the ordinary fuel in the matter of cost. The Chairman replied that comparative particulars respecting the firing of boilers by Mond gas and slack could not yet be furnished. It was never expected that a very great economy would be effected by the gas; but he would point out that the Mond Company had agreed to charge a certain percentage less than the cost of working the boilers with slack.

Dissolution of the Crediton Gas Company.—The Crediton Gas and Coke Company, at a recent general meeting of the shareholders, resolved, by 103 votes to 16, that the Company shall be "absolutely and entirely dissolved," in consequence of the concern having been disposed of to a Syndicate. In accordance with the Deed of Settlement, the meeting stood adjourned for a month, when the resolution to dispose of the business will have to be finally confirmed.

Free Electricity.—The people of Tonbridge who are not already electricity consumers cannot be got to take current for nothing. At the meeting of the Council last Wednesday, it was stated that there had not been up to date a single application for a free supply, as offered to new consumers during June, July, and August. The question of the legality of the free supply is to be introduced at the next Council meeting; but if there are no applications under the offer, there may be no opportunity for putting the matter to the test in a proper manner.

Reductions in Price.—The price of gas at Congleton has been reduced, as from the 1st inst., by 5d. per 1000 cubic feet for lighting and manufacturing purposes. The Hereford Town Council have, as from the 24th ult., made a reduction of 3d. per 1000 cubic feet in the price of gas supplied to private consumers, bringing it to 2s. 9d., subject to the usual discount of 3d. There will also be an additional discount of 3d. for gas-engines (making the net price for this purpose 2s. 3d. per 1000 cubic feet), and an allowance of 5s. per lamp off the cost of public lighting. These reductions, on the present consumption, represent close upon £1300.

The National Physical Laboratory.—At a meeting of members of Parliament held at the House of Commons last Tuesday afternoon, under the presidency of Mr. Haldane, on the subject of an additional State grant to the National Physical Laboratory, Dr. Glazebrook, the head of the establishment, referred to its aims and wants, and said their resources were hopelessly inadequate for the work they were asked to do. A statement had been drawn up and put before the Government, asking for a contribution of £30,000 for expenses and equipment of buildings, and for an annual grant of at least £10,000. The Treasury had granted them £5000 this year, and the annual grant had been raised to £6000. This, however was not sufficient for the work. The laboratory was a national institution. It did not come in any way into competition with the local institutions, but it was a necessary adjunct to the whole of their work. On the motion of Sir John Brunner, it was resolved to ask the Chairman and the conveners of the meeting to prepare and present a memorial to the Chancellor of the Exchequer asking for additional aid for the laboratory.

Sales of Stocks and Shares.—At the Mart, Tokenhouse Yard, E.C., last Tuesday, Mr. Alfred Richards sold, by order of the Directors, 400 additional ordinary £10 shares in the Lowestoft Water and Gas Company. They rank for a maximum dividend of 7 per cent., the last having been at the rate of 5¼ per cent.; and they fetched £10 16s. 3d. to £11 2s. 6d. each. He also sold £1000 of 4 per cent. perpetual debenture stock of the Company at from £104 5s. to £106 per £100 of stock. A new issue of £5 "B" shares in the Romford Gas Company, ranking for a maximum dividend of 7 per cent., but carrying 9 per cent. as from the 1st prox., was placed at £8 2s. 6d. to £8 5s. per share. On the same occasion, a few £25 shares in the Dorking Gas Company, carrying 5 per cent. dividend, fetched £24 15s. each. On Thursday, Messrs. Alexander, Daniel, and Co. sold by auction £15,000 of 7 per cent. maximum consolidated ordinary stock of the Bristol Water Company. It was put up in lots of £100, at the reserve price of £147. The highest offer was £151 5s.; the lowest, £150 17s. 6d.—the average being £151 0s. 9·6d. The total amount realized was £22,656.

The Liverpool Hennebique Ferro-Concrete Contracting Company, Limited, has been registered with a capital of £40,000, in £1 shares, to adopt an agreement with H. H. Carter, and to carry on the business of manufacturers of, and dealers in, concrete and ferro-concrete, or artificial stone of any description, steel manufacturers and converters, quarry proprietors, cement makers, &c. There is to be no initial public issue.

One of the most complete catalogues of shafting, pulleys, and power transmission accessories which have come under our notice has just been issued by the New Conveyor Company, Limited, of Smethwick. It has been artistically got up, and the contents include not only illustrations of the special plant concerned, with tabulated measurements and other particulars, but also some useful rules and tables bearing upon power transmission. The catalogue is worth a place on every engineer's table.

WANTED, FOR SALE, CONTRACT, &c. ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Partner with Capital Wanted. No. 4416.

Situations Wanted.
CLERK. No. 4430.
IN GAS-WORKS (PREMIUM OFFERED). No. 4425.

Exhibition. Application for space to Newcastle-on-Tyne Gas Company.

Stocks and Shares.
CROYDON GAS COMPANY. July 11.
WHITBY GAS COMPANY. Aug. 14.

TENDERS FOR

Benzol.
HEYWOOD GAS DEPARTMENT. Tenders by July 18.

Coal and Cannel.
CLACTON GAS DEPARTMENT. Tenders by July 19.
DEWSBURY GAS DEPARTMENT. Tenders by July 17.
LIMERICK GAS DEPARTMENT. Tenders by Aug. 5.
LINCOLN GAS DEPARTMENT. Tenders by July 15.
HAWORTH GAS DEPARTMENT. Tenders by July 26.
MARKET HARBOROUGH GAS DEPARTMENT. Tenders by July 15.

Gasholder and Steel Tank.
RHONDDA GAS AND WATER DEPARTMENT. Tenders by July 21.

Lime.
HEYWOOD GAS DEPARTMENT. Tenders by July 18.

Meters.
DEWSBURY GAS DEPARTMENT. Tenders by July 17.

Pipes and Fittings.
HEYWOOD GAS DEPARTMENT. Tenders by July 18.
DEWSBURY GAS DEPARTMENT. Tenders by July 17.

Roof, &c., and Tank.
COVENTRY GAS DEPARTMENT. Tenders by July 17.

Stoves and Cookers.
BELFAST GAS DEPARTMENT. Tenders by Aug. 9.
RHONDDA GAS AND WATER DEPARTMENT. Tenders by July 20.

Sulphate Saturator.
STOURBRIDGE GAS DEPARTMENT. Tenders by July 18.

Sulphuric Acid.
DEWSBURY GAS DEPARTMENT. Tenders by July 17.
HEYWOOD GAS DEPARTMENT. Tenders by July 18.

Tar and Liquor.
CAXTON TYPE FOUNDRY, MARKET HARBOROUGH.
HEYWOOD GAS DEPARTMENT. Tenders by July 18.
LITTLEBOROUGH GAS COMPANY. Tenders by July 22.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."
United Kingdom: One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.
Payable in Advance. If credit is taken, the charge is 25s. a year.
Abroad (in the Postal Union): £1 7s. 6d., payable in Advance.

All Communications, Remittances, &c., to be addressed to
WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.
JOHN WM. O'NEILL,
Managing Director,
PALMERSTON HOUSE, LONDON, E.C.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
BROTHERTON AND CO, LTD., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

AMMONIACAL Liquor wanted.
BROTHERTON AND CO., LTD., Ammonia Distillers. Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, AND WAKEFIELD.

PATENTS AND TRADE MARKS
PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

SULPHATE OF AMMONIA
SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
Telegrams: SATURATORS, BOLTON. Telephone 0848.

GAS TAR wanted.
BROTHERTON AND CO., LTD., Tar Distillers. Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, AND WAKEFIELD.

GLASS SHADES of every description, for all kinds of Interior **GAS LIGHTING.**
Illustrated sheets on application.
JOHN WALSH WALSH,
SOHO AND VESTA GLASS WORKS, BIRMINGHAM.
Telegrams: "VESTA, BIRMINGHAM."
National Telephone: No. 63.
London Show-Room: 4, HOLBORN CIRCUS, E.C.

"VITERNUS" METALLIC PAINT FOR GAS-WORKS PLANT.
JOHN E. WILLIAMS AND CO.,
LOWER MOSS LANE,
MANCHESTER, S.W.
Telegrams: "ENAMEL." National Telephone 1759.

SPENT OXIDE.
THE South Metropolitan Gas Company are always open to receive OFFERS of SPENT OXIDE.
Chief Office: 709, Old Kent Road, London, S.E.
Telegrams: "METROGAS, LONDON."

TAR AND LIQUOR WANTED.
Best Prices paid.
DENT AND CO.,
Ouse Chemical Works, SELBY.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 54 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 254 Oldham, and 2412 HOP, London.
Telegrams:—
"BRADDOCK, OLDHAM," and "METRIQUE, LONDON."

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SPENT OXIDE PURCHASED IN ANY DISTRICT.

THE First Dutch Bogore Co., Ltd.,
HOLLAND.
General Manager (for England and Wales)—
CHARLES E. FRY, LEAMINGTON.
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J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

ATTERTON'S Patent Charging Machine, especially adapted for Small Works up to 50 Millions. Nearly 40 already supplied, and still supplying. Would soon repay for small outlay. Increased make and reduction in cost.
Apply to E. PADFIELD AND CO., 96 & 98, Leadenhall Street, LONDON, E.C.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

BROTHERTON & CO., LIMITED.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

BIGGS, WALL, & CO., 13, Cross Street,
Finsbury, E.C. *Telegrams:* "RAGOUT," LONDON.
Telephone: 273 CENTRAL.
SULPHATE PLANTS—See Advt. in last week's issue.
CHARGING MACHINERY—See Advt. in this week's issue.
SATURATORS—See Advt. in next week's issue.

REQUIRED, a position as Clerk in a Gas Company. Provinces or Abroad. Eight-and-a-half years' Experience in a London Company. Speciality, Automatic Work. Age 25. Excellent References.
Address No. 4430, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

£50 Premium for introduction leading to suitable Permanent Situation. Age 30. Married. Fourteen Years' Gas-Works Experience. Understands Generator and Regenerative Furnaces. Good Testimonials.
Address No. 4425, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

PARTNER with Capital Invited for established Gas Engineering Business, town and country; also for Purchase and Working of Gas-Works. Perfect security.
Address, No. 4416, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS Tar out of a Crossley Bituminous Plant for Sale. Sample submitted.
Apply to the MANAGER, Caxton Type Foundry, MARKET HARBOROUGH.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters. Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

TO BE SOLD—Vertical Duplex Gas- Engine by Griffin, 60 I.H.P. Cylinders 11 inches diameter by 13-inch stroke, double Fly Wheels, outside Bearings, Tube Ignition, nearly new.
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BALE & CHURCH will be pleased to send Quotations and Samples on application.
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BALE'S FIRE CEMENT for all Retort and Furnace work.
PAINT for Gasholders, Purifiers, &c.
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SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
SPENCER, CHAPMAN, AND MESSEL, LIMITED, 36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 341, AVENUE.

NEWCASTLE-ON-TYNE GAS EXHIBITION.

(Under the Auspices of the NEWCASTLE-UPON-TYNE AND GATESHEAD GAS COMPANY).

AN Exhibition of Gas Appliances for LIGHTING, HEATING, and POWER will be held in the Newcastle Exhibition Buildings, the largest Hall in Newcastle-upon-Tyne, from the 13th to the 27th of September next.
Applications for space for Exhibits of interest are invited.
The charges for space will be nominal and Gas will be supplied at 2s. per 1000 cubic feet less 50 per cent. discount for prompt payment.
Prospectus and Forms of Application for space will be sent upon request to the JOINT MANAGERS, Newcastle-upon-Tyne Gas Exhibition, 43, Grainger Street, NEWCASTLE-UPON-TYNE.

TENDERS FOR GAS COAL.

THE Gas Committee of Limerick invite TENDERS on or before the 5th of August for 8000 or 17,000 Tons of GAS COAL, according to Specification to be had on application at the Gas Offices, 34 and 35, William Street, LIMERICK.
July 5, 1905.

MARKET HARBOROUGH URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Gas Committee invite Tenders for the supply of the whole or part of 4000 Tons of best screened GAS COAL, to be delivered during the Year ending July 31, 1906, at the London and North Western or Midland Railway Station, Market Harborough.
Conditions and Form of Tender may be obtained from the undersigned, to whom sealed Tenders, endorsed "Coal," must be delivered not later than Saturday, the 15th of July next.
The lowest or any Tender not necessarily accepted.
ALFRED T. HARRIS,
Manager and Secretary.
Gas Offices, St. Mary's Road,
Market Harborough, June 28, 1905.

BOROUGH OF HEYWOOD.

THE Gas Committee invite Tenders for the supply of LIME, TUBES and FITTINGS, SULPHURIC ACID, and BENZOL; and also for the purchase of surplus TAR.
Specification and Form of Tender may be obtained from Mr. W. Whatmough, Gas Manager.
Contractors tendering for this work must pay their workpeople at least the Standard or Trade Union Rate of Wages, and observe the Trade Conditions which attach to the various kinds of work for which the Tender is sent in.
Sealed and endorsed Tenders to be sent to me not later than Tuesday, July 18, 1905.
By order
GEO. G. BOUCHIER,
Town Clerk.
Municipal Buildings, Heywood,
June 14, 1905.

ROBERT DEMPSTER & SONS, Ltd.,
Contractor for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, ROSE MOUNT IRON-WORKS, ELLAND.

THE Haworth Urban District Council are prepared to receive TENDERS for the supply of 2400 Tons of GAS COAL (screened, unscreened, and Gas Nuts) delivered at the Haworth Station during the ensuing Twelve Months.

Sealed Tenders, endorsed "Gas Coal Tender," to be forwarded to me, the undersigned, not later than the 26th inst.

No special Form of Tender.

WILLIAM ROBERTSHAW,
Clerk to the Council.

1, Burlington Chambers,
North Street, Keighley.

CITY AND COUNTY BOROUGH OF BELFAST.

THE Gas Committee of the Corporation invite TENDERS for the supply of GAS COOKERS, HEATING STOVES, and other Appliances, for One Year from September 1, 1905.

Parties tendering must supply a complete sample of their Goods, and all the goods are to be delivered free into the Corporation Stove Warehouse, Ormeau Road.

Tenders, endorsed "Tender for Gas Appliances," addressed to Sir Saml. Black, Town Clerk, Belfast, are to be furnished not later than Wednesday, the 9th of August, 1905.

The lowest or any Tender not necessarily accepted.

JAMES STELFOX,
Engineer and Manager.

RHONDDA URBAN DISTRICT COUNCIL.
(GAS AND WATER DEPARTMENT.)

THIS Council are prepared to receive TENDERS for the supply of GAS-COOKING STOVES for the Year ending the 30th of June, 1906.

Specification may be obtained, and Form of Tender supplied, upon application to Mr. Octavius Thomas, the Engineer and Manager, Gas and Water Offices, Pentre, Glam.

The Contractor will be required to pay the Standard Rate of Wages recognized in the district.

Tenders to be addressed to the Chairman of the Gas and Water Committee, endorsed "Gas-Cooking Stoves," and delivered at my Office not later than Ten a.m. on Thursday, the 20th inst.

The Council do not bind themselves to accept the lowest or any Tender.

WALTER P. NICHOLAS,
Clerk.

Council Offices, Pentre,
Glam., July 8, 1905.

RHONDDA URBAN DISTRICT COUNCIL.
(GAS AND WATER DEPARTMENT.)

GASHOLDER AND STEEL TANK.
CONTRACT No. 31.

THIS Council are prepared to receive TENDERS for One SINGLE-LIFT GASHOLDER, 80 feet diameter, 20 feet deep, on the Gadd and Mason Patent Spiral Principle, with Dempster's Patent Spiral Plates, and STEEL TANK for same.

Plans and Specifications may be seen, and Forms of Tender supplied, upon application to Mr. Octavius Thomas, the Engineer and Manager, Gas and Water Offices, Pentre, Glam., upon depositing the sum of One Guinea, which will be returned on receipt of a *bonâ-fide* Tender, but to be forfeited in the case of withdrawal of Tender after acceptance by the Council.

The Contractor will be required to pay the Standard Rate of Wages recognized in the district.

Tenders to be addressed to the Chairman of the Gas and Water Committee, endorsed "Gasholder Contract, No. 31," and delivered at my Office not later than Ten a.m. on Friday, the 21st inst.

The Council do not bind themselves to accept the lowest or any Tender.

WALTER P. NICHOLAS,
Clerk.

Council Offices, Pentre,
Glam., July 8, 1905.

TO IRONFOUNDERS AND ROOF CONTRACTORS.

THE Gas Committee of the Coventry Corporation invite TENDERS for the supply and erection of the following WORK:—

SPECIFICATION No. 21.

STEEL ROOFS with supporting Cast-Iron Columns and covered with Corrugated Sheeting, for an Oxide and Lime Shed, 172 ft. by 62 ft. 6 in. and Coke Shed, 50 ft. by 30 ft. Also STEEL ROOFS for the following buildings: Generator House, 46 ft. 9 in. by 46 ft. 9 in., Boiler House, 34 ft. 6 in. by 45 ft. 3 in., and Exhauster House, 32 ft. by 45 ft. 3 in. Also a Steel Joist Floor, 33 ft. 9 in. by 12 ft. 6 in.

Approximate total weight of material 182 Tons.

SPECIFICATION No. 22.

Cast-Iron Elevated WATER TANK 17 ft. by 32 ft. with Girders to support same, Cast-Iron Staircase, and Chimney Cap.

Total weight of material, about 43 Tons.

Copies of Form of Tender, with Specifications, Bills of Quantities, and blue Prints of Drawings, may be obtained on application to the undersigned, and on payment of 30s. in respect of Specification No. 21, and 15s. in respect of Specification No. 22. These payments will not be returned.

The Committee do not bind themselves to accept the lowest or any Tender.

Tenders must be delivered not later than the first post on July 17, 1905, addressed to the Chairman of the Gas Committee, Gas-Works, Coventry, and endorsed respectively "Tender for Roofs" and "Tender for Cast-Iron Water Tank, &c."

FLETCHER W. STEVENSON,
Engineer and General Manager.

Gas-Works, Coventry,
July 1, 1905.

BOROUGH OF DEWSBURY.

THE Lighting Committee are prepared to receive TENDERS for the supply and delivery at their Gas-Works Siding, Saviletown, Dewsbury, of the following quantities of Screened GAS COAL during One, Two, or Three Years, commencing on the 1st day of August next:

First Year, 20,000 Tons of Black and 2000 Tons of Cannel.
Second Year, 20,000 Tons of Black and 2000 Tons of Cannel.
Third Year, 20,000 Tons of Black and 2000 Tons of Cannel.

Tenders must specify for delivery by rail, and to be made on Forms to be had on application to Mr. Chas. A. Craven, Saviletown Gas-Works, Dewsbury, from whom any further Information may be obtained.

Sealed Tenders, endorsed "Tenders for Coal," to be sent to me not later than Monday, the 17th day of July next.

The Committee do not bind themselves to accept the lowest or any Tender.

H. ELLIS,
Town Clerk.

Town Clerk's Office, Town Hall,
Dewsbury.

BOROUGH OF DEWSBURY.

THE Gas Committee of the above Corporation invite TENDERS for the supply and delivery during the period ending the 31st day of July, 1906, of:

1—SULPHURIC ACID.
2—WET AND DRY GAS METERS.
3—CAST-IRON GAS AND WATER PIPES.

Specifications and Forms of Tender may be obtained on application to the Gas Engineer, Mr. Chas. A. Craven, Gas-Works, Saviletown, Dewsbury.

Tenders, under sealed covers, endorsed "Sulphuric Acid," "Meters," or "Cast-Iron Pipes," as the case may be, to be sent to me not later than Monday, the 17th day of July next.

The Corporation do not bind themselves to accept the lowest or any Tender.

H. ELLIS,
Town Clerk.

Town Hall, Dewsbury.

LINCOLN CORPORATION.
(GAS DEPARTMENT.)

TENDERS FOR COAL.

THE Gas Committee of the Lincoln Corporation invite TENDERS for the supply of 26,000 Tons of screened or unscreened GAS COALS, to be delivered during a period commencing the 1st of August, 1905, and terminating the 31st of July, 1906.

Further Particulars and Forms of Tender may be obtained from the undersigned.

Sealed and endorsed Tenders, addressed to the Chairman of the Gas Committee, must be delivered on or before the 15th of July next.

The Committee do not bind themselves to accept the lowest or any Tender.

JNO. CARTER,
Manager.

Gas Offices, Lincoln,
June 28, 1905.

CLACTON URBAN DISTRICT COUNCIL.

THE above Council invite Tenders for the supply and delivery of about 4000 Tons of best screened GAS COAL at Clacton-on-Sea in quantities as may be required during the ensuing Twelve Months,

Particulars and Form of Tender may be obtained on application to the Engineer, Mr. Sydney Francis, Assoc.M.Inst.M.E., Town Hall, Clacton-on-Sea.

Tenders, sealed and endorsed "Tender for Coal," to be delivered to the undersigned not later than Four o'clock p.m. on Wednesday, July 19 next.

The Council do not bind themselves to accept the lowest or any Tender.

GEO. T. LEWIS,
Clerk to the Council.

Town Hall Buildings,
Clacton-on-Sea.

LITTLEBOROUGH GAS COMPANY.

TENDERS FOR TAR.

THE Directors of the above Company invite TENDERS for the surplus TAR produced at their Works from Aug. 1, 1905, to July 31, 1906, delivered in Contractors' Tanks at Littleborough Station (L. & Y.).

Quantity, about 370 Tons.

The Directors do not bind themselves to accept the highest or any Tender.

Tenders to be addressed to the undersigned not later than July 22, 1905.

S. E. HALLIWELL,
Manager and Secretary.

Gas Office, Hare Hill Road,
Littleborough, July 6, 1905.

URBAN DISTRICT COUNCIL OF STOURBRIDGE.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the supply, delivery, and connecting up to existing Plant of a new SATURATOR about 6 ft. by 4 ft. 3 in., to be made solid rolled plate or cast lead.

Further Particulars on application.

Tenders to be endorsed "Saturator," addressed to the Chairman of the Gas Committee, and sent to me on or before Tuesday, July 18, 1905.

WM. NORTH,
Engineer and Manager.

Stourbridge Gas-Works,
July 1, 1905.

WHITBY GAS COMPANY.

SALE BY TENDER OF 300 NEW ORDINARY SHARES.

NOTICE is Hereby Given, that it is the intention of the Directors of the Whitby Gas Company to SELL by TENDER, to be received at the Company's Office, Baxtergate, Whitby, not later than the 14th day of August, 1905,

THREE HUNDRED NEW ORDINARY SHARES of Ten Pounds each.

The Shares now for sale constitute a first issue of Additional Capital, which will be issued in accordance with the provisions of the Whitby Gas Act, 1904.

Any number of shares (not exceeding ten in each single lot) may be applied for. The Shares will be allotted to the highest Tenderers, at and above the reserve price.

Particulars and Conditions, with Forms of Tender, can be obtained from the undersigned.

WM. M. GALLEWAY,
Secretary.

Gas Office, Whitby, July 7, 1905.

To Trustees and Others.

MESSRS. HOOKER & WEBB have received instructions to SELL BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on Tuesday, July 11, at Two o'clock precisely, in 164 Lots,

£15,000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK of the CROYDON GAS COMPANY.

Particulars and Conditions of Sale may be had of the SECRETARY at the Offices of the Company, Katharine Street, CROYDON; at the MART, E.C.; and of the AUCTIONEERS, 4, High Street, CROYDON. Telephone No. 122 Croydon.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

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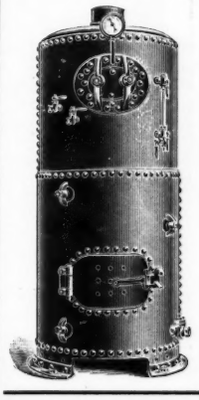
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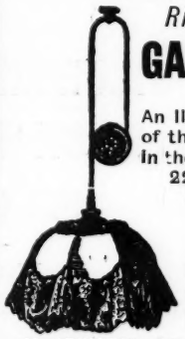
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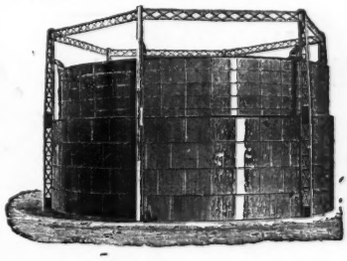
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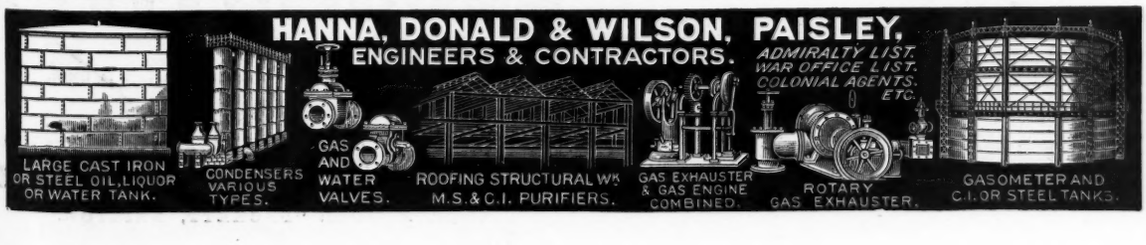
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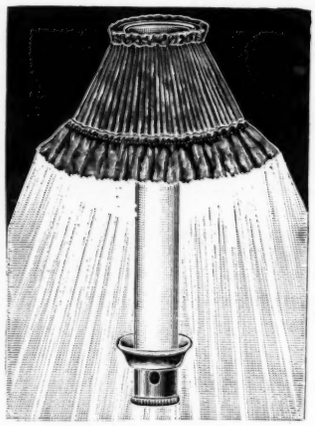
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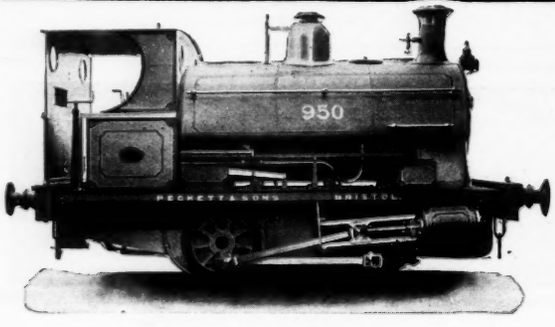

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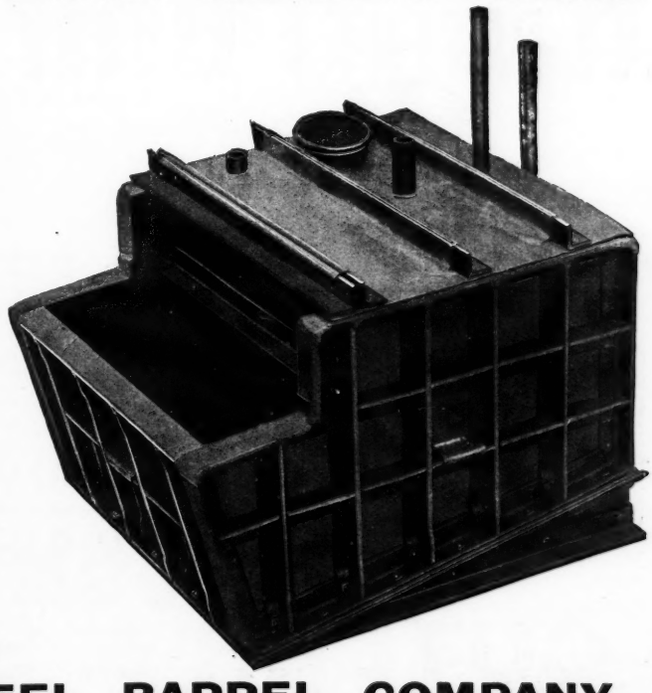

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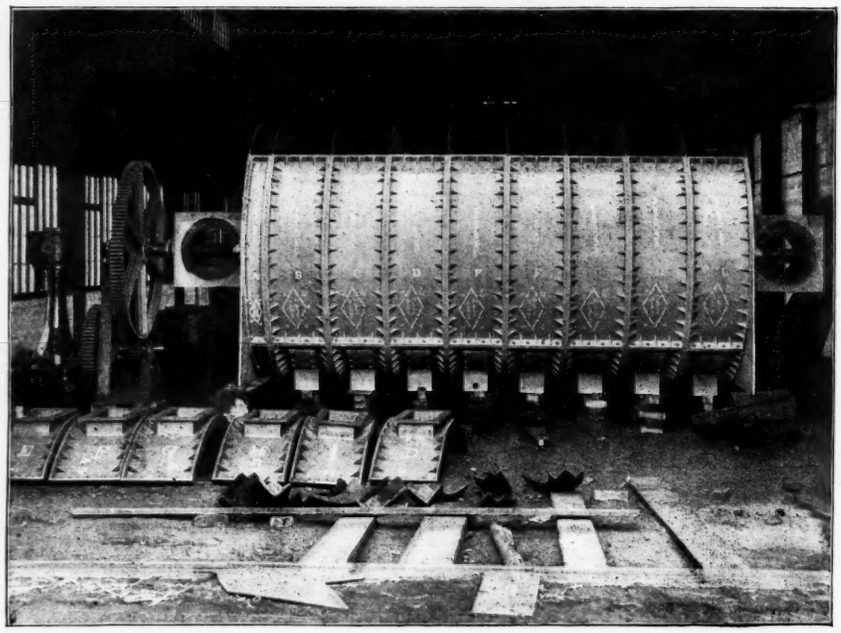

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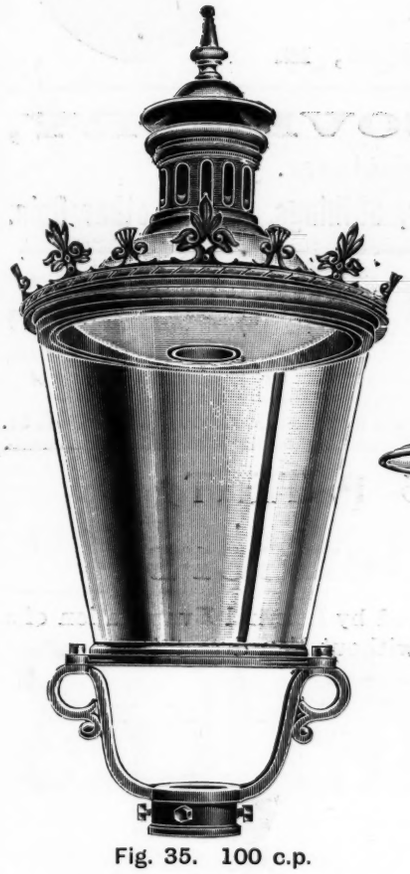
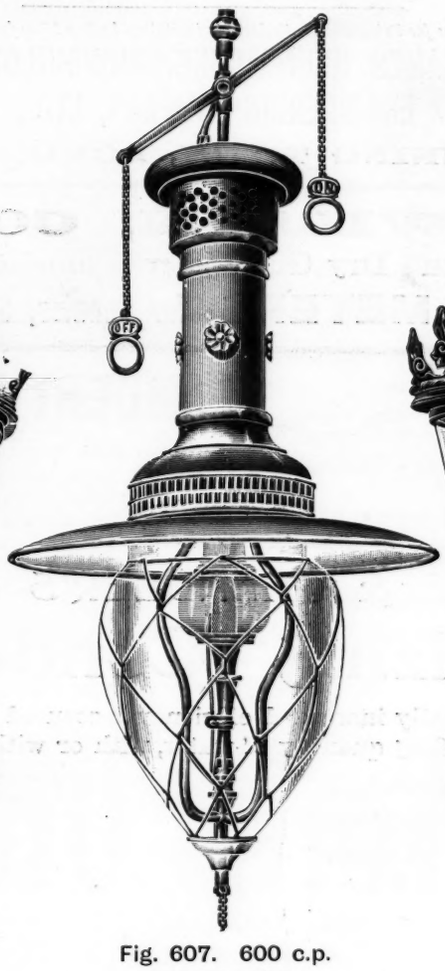


Fig. 35. 100 c.p.



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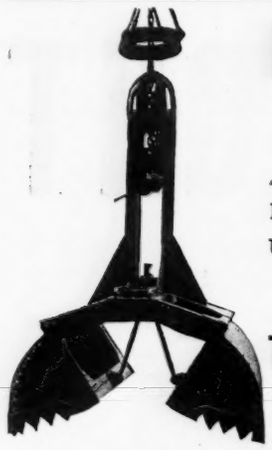

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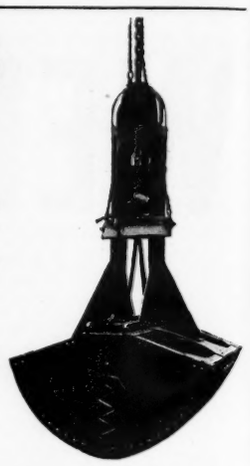

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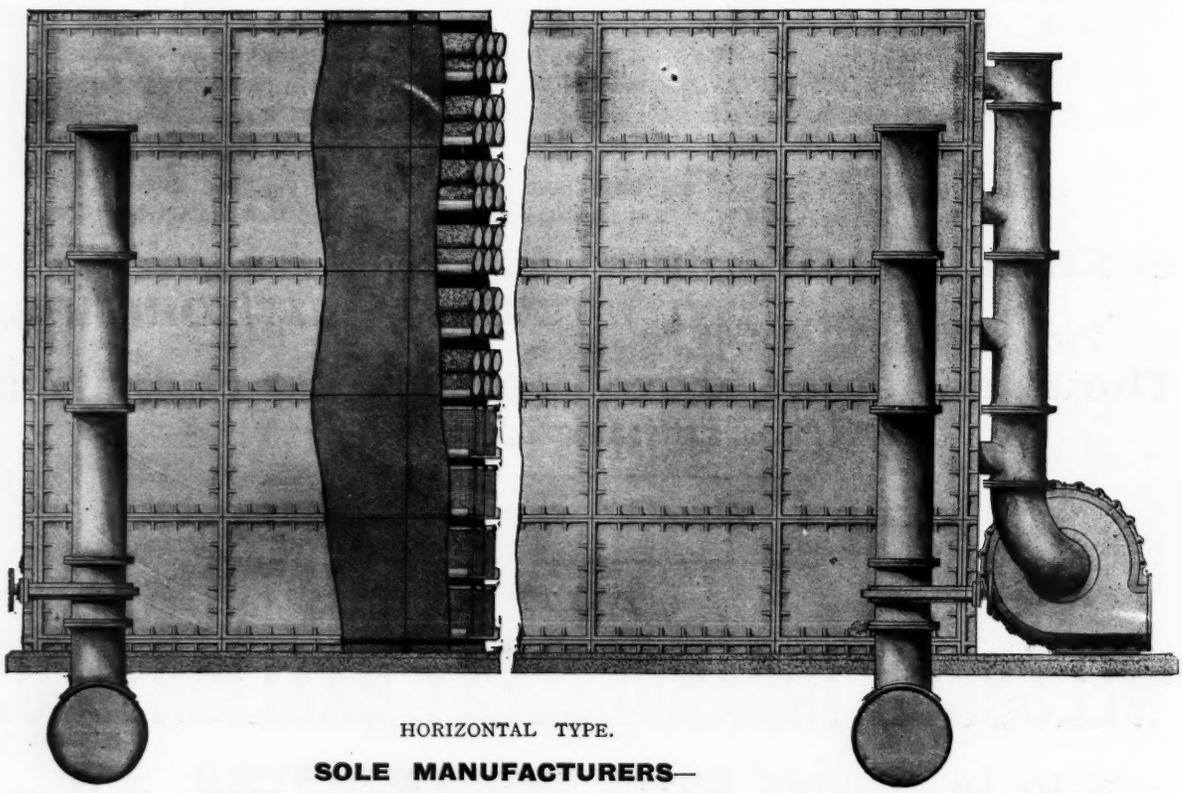

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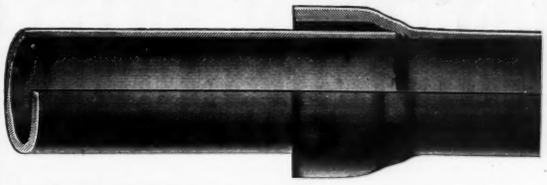

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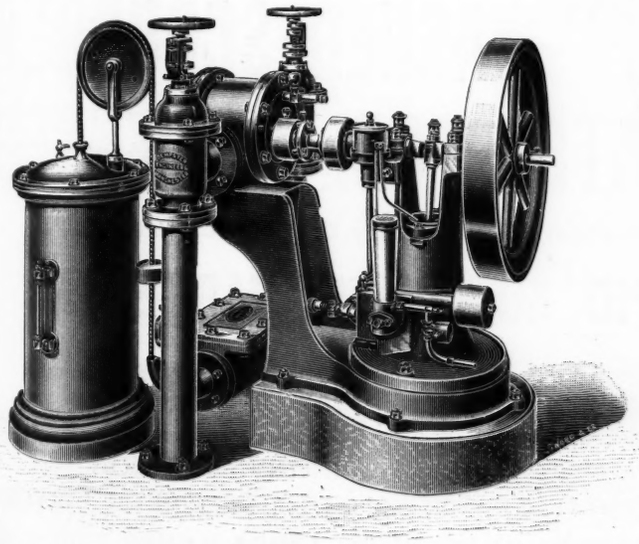

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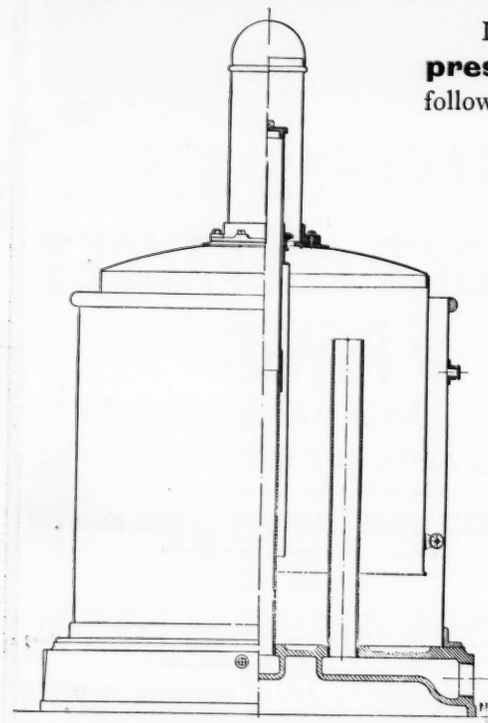

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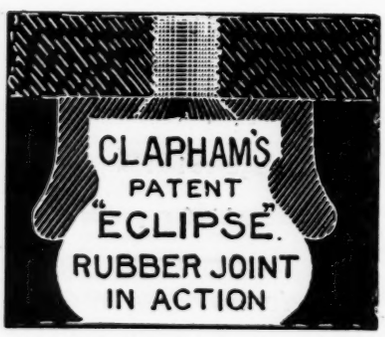
Clapham's Patent **"ECLIPSE" WATER-TUBE CONDENSER**

Clapham's New Century Cover, with Patent



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Printed for WALTER KING by King, Sell, & Olding, Ltd.; and published by him at 11, BOLT COURT, FLEET STREET, in the CITY OF LONDON.—Tuesday, July 11, 1905.